16 FEBRUARY 1950

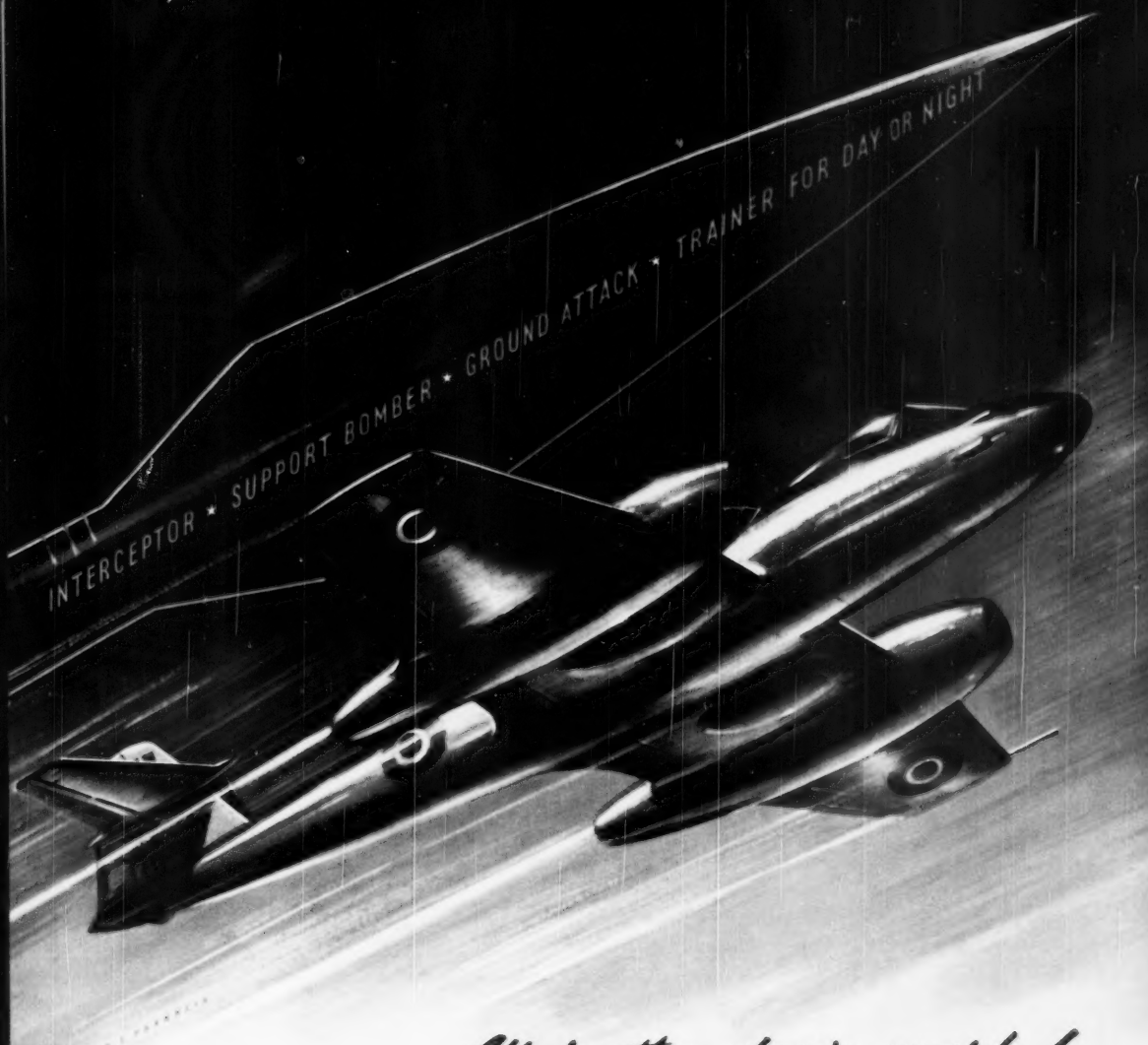
ONE SHILLING

FLIGHT

and

AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB



All in the day's work!

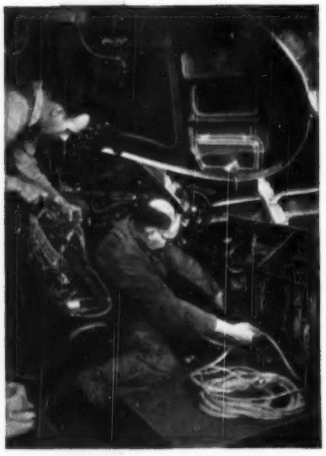
GLOSTER METEOR

GLOSTER AIRCRAFT CO LTD (BRANCH OF THE HAWKER SIDDELEY GROUP)

for all electrical services

The VICKERS VISCOUNT 700

RELIES UPON BICC AIRCRAFT CABLES



Electrical wiring being installed in Pilot's cockpit.

To take advantage of the increased power available with the new Rolls-Royce 1,400 s.h.p. "DART" RDa 3 Turboprops, Vickers-Armstrong have evolved the Viscount 700—a new variation of the basic Viscount airframe.

Silence and lack of vibration are special features of the new Viscount, while the larger fuselage, greater wingspan and fuel-capacity allow an increased payload.

For all electrical services, this aircraft has been equipped throughout with BICC Aircraft Cables.

B.I. Callender's

AIRCRAFT CABLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

In the field of engineering, Terry's are regarded as the gateway to knowledge of springs and presswork. It is a reputation founded on over ninety years' study of this subject. During this time every important development in springs and presswork has been pioneered by Terry's — many of the special parts they have produced to meet unusually exacting requirements have been hailed as little masterpieces of functional design. They may be made in millions, but at Terry's every part is guaranteed for absolute accuracy. If *you* have a spring or presswork problem turn to Terry's for advice. *They* have the knowledge and experience to solve it.

St. John Gate, Clerkenwell

was built by Prior Docwra in 1504 and formed part of the old priory of the Knights of St. John of Jerusalem. The rooms over the gateway and the adjoining premises today house the St. John Ambulance Association.

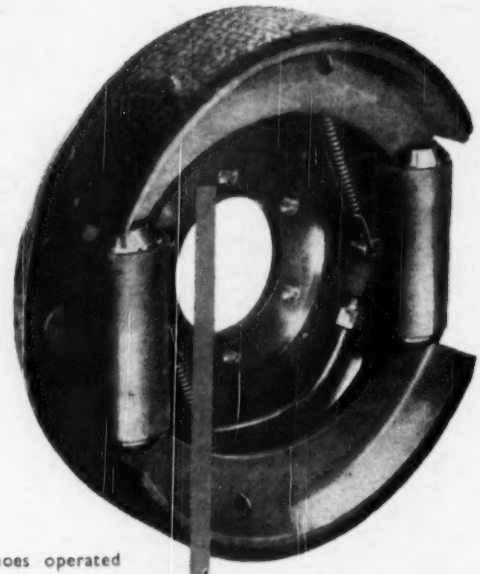
TERRY'S

the gateway to knowledge of

SPRINGS & PRESSWORK

HERBERT TERRY & SONS LIMITED, REDDITCH, ENGLAND

THE NEW HYDRA-STATIC TWO LEADING SHOE AIRCRAFT BRAKE



THIS brake consists of two self-aligning shoes operated by two wheel cylinders spaced diametrically opposite. Each wheel cylinder has two pistons of a different form : one having a slot at right angles to the axis of the bore, which operates the shoe when the brake is used in forward rotation and the other with the slot inclined at an angle to the bore which forms the abutment for the other shoe in similar condition. This inclined slot has a predetermined angle which allows the shoe to align itself accurately to the drum as well as forming the abutment. The total shoe reaction is transmitted via a shoulder on the piston to the cylinder body. By this arrangement, two-leading shoe operation is obtained in either direction, and greater power for a given input and greater stability is obtained.

TYPICAL FIGURES

5⅞" x 1½"	Approximate maximum dynamic torque 2,950 lbs. inches, at 60 lbs. per sq. inch lining drag. Two ¾" diameter cylinders.
7" x 1½"	Approximate maximum dynamic torque 4,200 lbs. inches, at 60 lbs. per sq. inch lining drag. Two ¾" diameter cylinders.

Master cylinder for use with the above brakes is a ⅝" diameter x 1¼" stroke design.

GIRLING

THE BEST BRAKES IN THE WORLD

GIRLING LIMITED, KINGS RD., TYSELEY BIRMINGHAM 11

A Naval Prototype

THE Y.A.5 ANTI-SUBMARINE AIRCRAFT

BLACKBURN & GENERAL AIRCRAFT LIMITED, BROUGH, EAST YORKS

HEARTY

CONGRATULATIONS

to

"Bristol"

on their 40th Anniversary

DUNLOP

Aviation Division

Foleshill, Coventry

SDH/608

Designed by Vickers-Armstrongs . . .

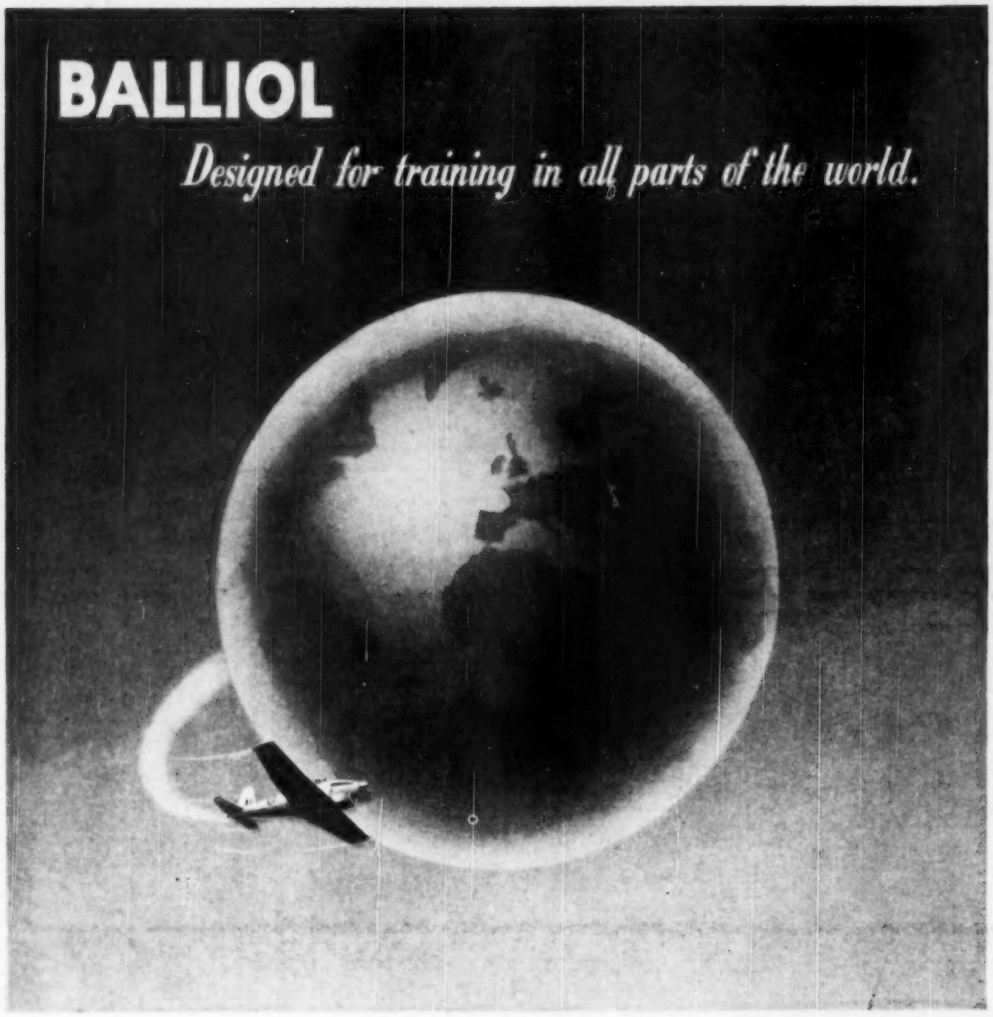
powered by Bristol

For many years a spirit of co-operation has existed between these two great firms—to the benefit of British Aviation.
On the occasion of the Bristol Aeroplane Company's fortieth anniversary, Vickers-Armstrongs send their congratulations and best wishes for the future.

VICKERS-ARMSTRONGS LIMITED AIRCRAFT DIVISION WEYBRIDGE AND SUPERMARINE WORKS

BALLIOL

Designed for training in all parts of the world.

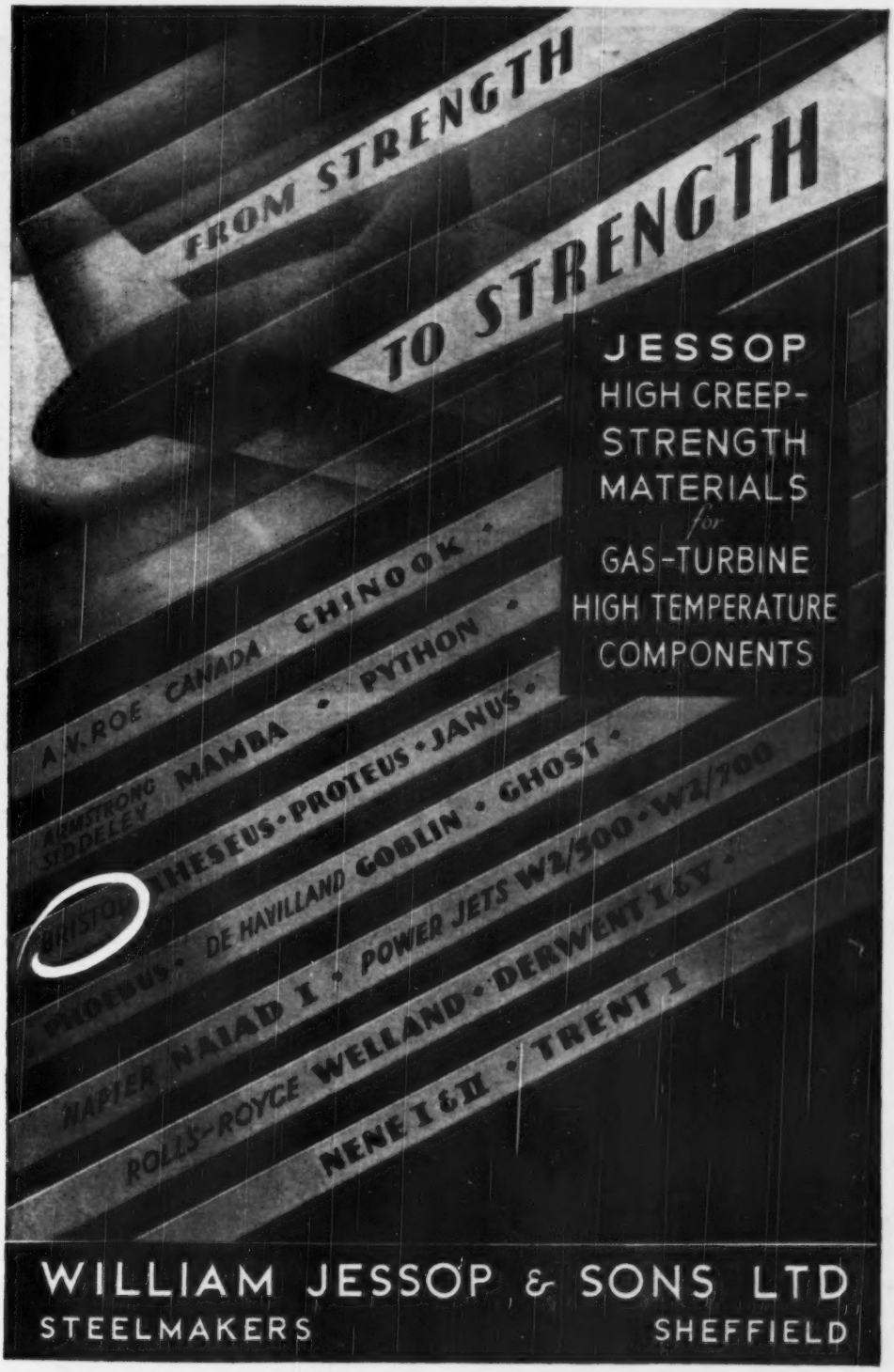


In the course of its official trials by the Royal Air Force, the Balliol T.2 has been thoroughly tested under tropical conditions and has proved itself as satisfactory for Service use in the tropics as in more temperate climates.

With its service ceiling of 32,500 feet, the Balliol T.2 maintains a rate of climb of over 2,000 feet per minute to a height of 11,500 feet above sea level, and can thus be operated without difficulty from high altitude aerodromes. At 8,000 feet, its take-off distance to clear a 50-ft. screen does not exceed 640 yards.

BOULTON PAUL AIRCRAFT LTD.

WOLVERHAMPTON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MATERIALS
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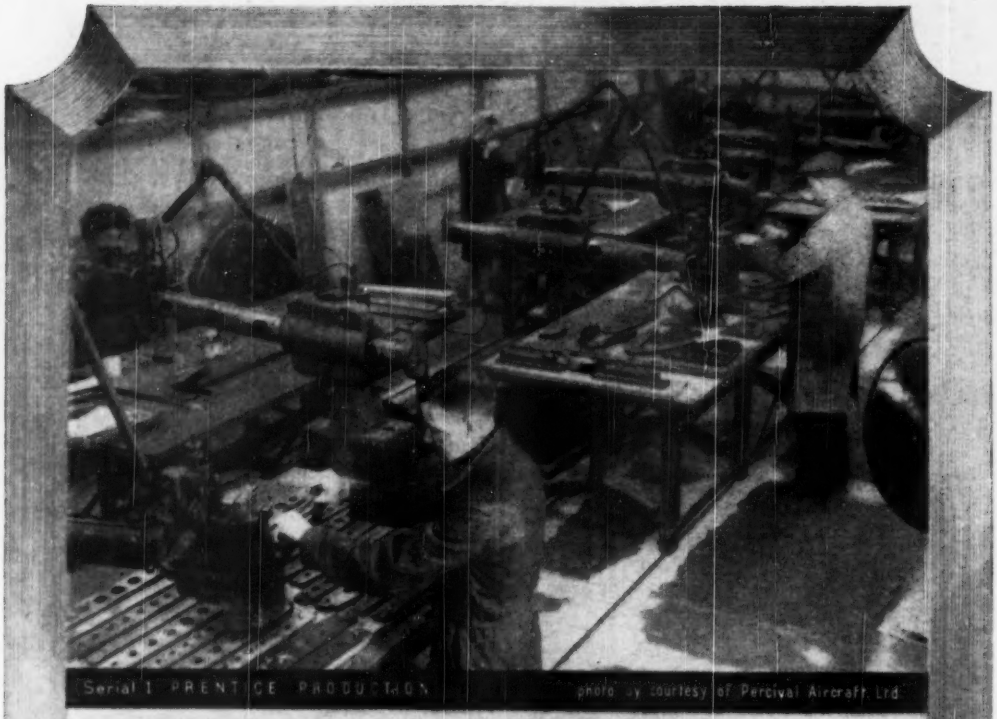
STEELMAKERS
SHEFFIELD



Hydulignum

for

Press Tools · Jigs · Templates

used by

THE DE HAVILLAND AIRCRAFT CO. LTD. ★ THE BRISTOL AEROPLANE CO. LTD. ★ WESTLAND AIRCRAFT LTD.

AIRSPEED LTD. ★ FOLLAND AIRCRAFT LTD.

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laminated compressed
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"the made to measure wood"
HADDENHAM-BUCKS-ENGLAND

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Congratulations to The Bristol Aeroplane Company who have maintained their high standard during 40 years of service to world aviation

Standard,

consulting radio engineers to The Bristol Aeroplane Company, are proud to have been associated with the production of the "BRABAZON" and "WAYFARER"

Standard Telephones and Cables Limited (RADIO DIVISION)

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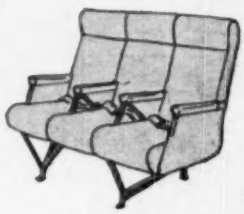
OAKLEIGH ROAD, NEW SOUTHGATE, LONDON, N.11

RUMBOLD SEATING FOR ALL NEEDS

HIGH DENSITY SEATS

M/292
Weight 20½ lbs.

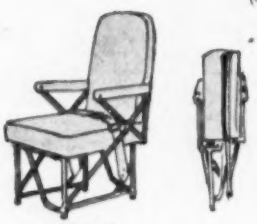
M/273
Weight 34 lbs.



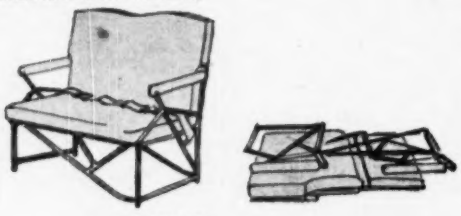
M/287
Weight 39 lbs.

FOLDING FREIGHTER SEATS

(Folding operation carried out in seconds)



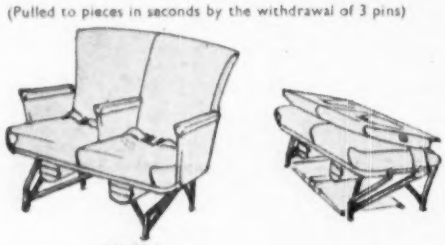
LAR/142
Weight 21 lbs.



LAR/143
Weight 26 lbs.

DOUBLE DISMOUNTABLE SEAT

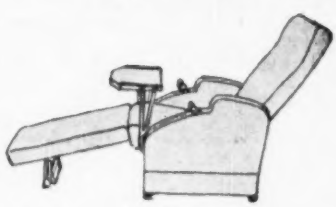
(Pulled to pieces in seconds by the withdrawal of 3 pins)



M 274
Weight 37 lbs.

LUXURY SEAT

(Lever adjustable type)



M 152
Weight 34 lbs. Not including leg-rest and table.

All weights include safety belts, leg fittings and where applicable ashtrays and lifebelt holders.

All weights can be reduced by modifying the upholstery schemes.

All models are ARB approved.

All models are in Service and giving great satisfaction all over the World.

All RUMBOLD'S seats are detached from the aircraft deck in seconds by the use of the Rumbold quick release deck fitting.

RUMBOLD

L. A. RUMBOLD & CO. LTD., KILBURN, N.W.6 *Telephone: MAIDA Vale, 7366-7-8*

1925

Here is the first aero engine as manufactured by "Bristol" — the Jupiter which carried equipment by Hobson.

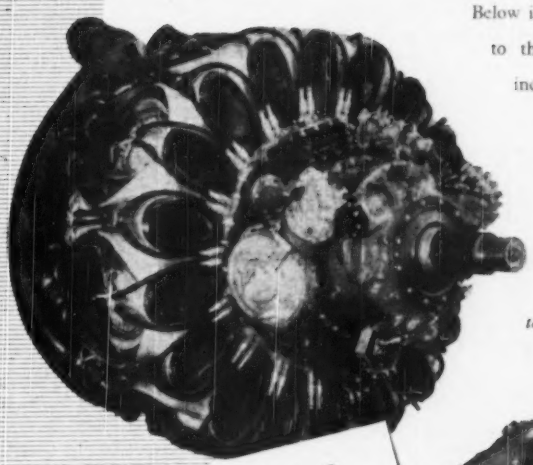
Hobson

are proud of their long association with Bristol achievement

In offering our congratulations to the Bristol Aeroplane Company on their 40th Anniversary, we are happy to record the privilege of having supplied equipment including carburetters, injectors, boost & mixture controls and cockpit (engine) controls for "Bristol" aircraft and engines since 1925.

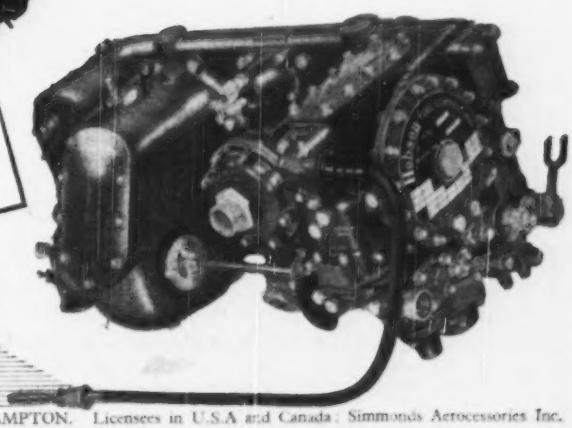
Below is illustrated our B.C. 15 Injection Carburetter fitted to the latest "Bristol" Centaurus 661 Engine which incorporates the following outstanding features :—

• Absence of external pipe lines and accessibility of all tuning adjustments. • Boost Control Unit integral with Adaptor Plate and incorporating a built-in Servo Motor to relieve load on pilot's throttle operating lever. • Interchangeability of Fuel Pump and Fuel Control Unit. • Oil-heated Throttles. • Provision for the incorporation of a mechanical type Boost Override and a Methanol and Water System. • Fuel Control Unit completely responsive to boost pressure throughout whole operating range.



1950

The "Bristol" Centaurus 661 on which Hobson equipment is used, including the new Hobson B.C. 15 Injection Carburetter illustrated.



H. M. HOBSON LTD., FORDHOUSES, WOLVERHAMPTON. Licensees in U.S.A and Canada : Simmonds Aerocessories Inc.

Sir George Godfrey

and Partners

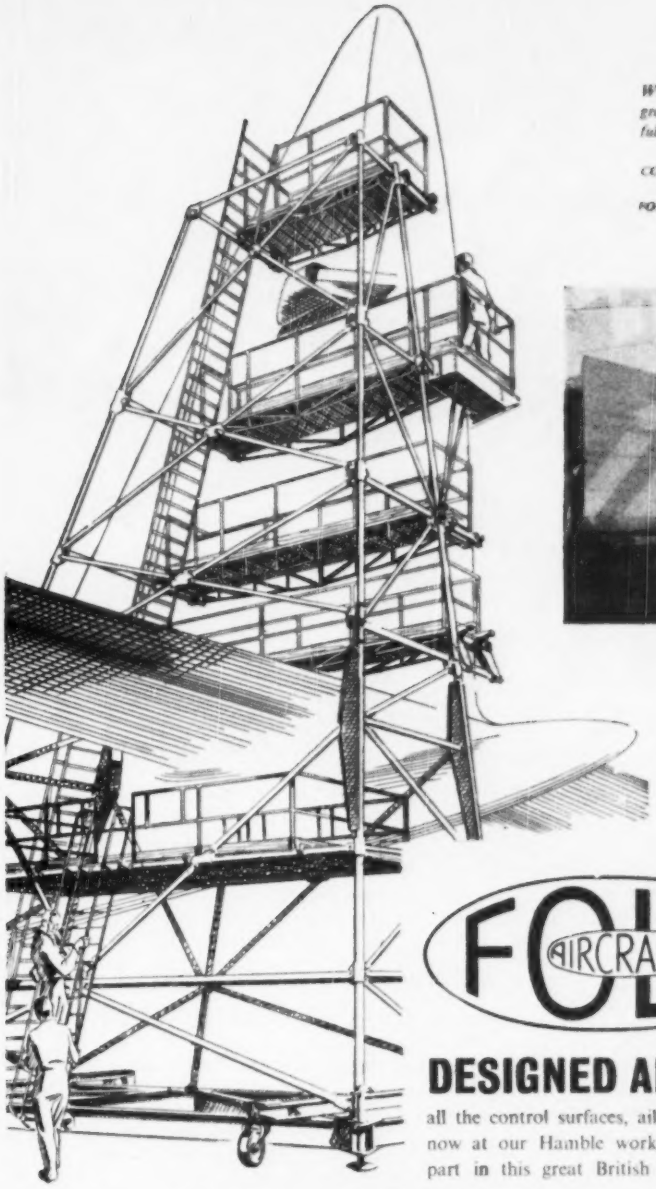
make their bow.

Our somewhat light-hearted interpretation of this company's name in no way detracts from the sincerity with which we make our bow to that pioneer aircraft organisation, THE BRISTOL AEROPLANE COMPANY LIMITED, on reaching the aeronautically fine old age of two-score years. Because we are so young by comparison, we consider it all the more a privilege to have collaborated with The Bristol Aeroplane Company on the installation of our equipment in the Brabazon I and now to be entrusted with the cabin pressurising and air conditioning of the new Bristol Type 175 Turbine-Propeller aircraft. With cabin pressurisation and air conditioning assuming ever greater importance, we trust that this association may continue for many years to come.

Sir George Godfrey & Partners Limited. HAMPTON ROAD, HANWORTH, MIDDLESEX, ENGLAND.

Telephone: FELtham 3291 *Cables: Godfreyair, London*

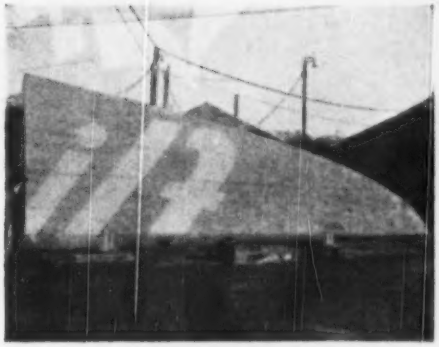
B.2



We design and construct aircraft, components and ground-handling equipment. Our Design Group is fully approved for civilian and service aircraft design as well as for research work.

CONTRACTORS TO MINISTRY OF SUPPLY (AIR)

FOLLAND AIRCRAFT LTD., HAMBLE, SOUTHAMPTON



BRABAZON RUDDER
Ready for dispatch from Folland's factory

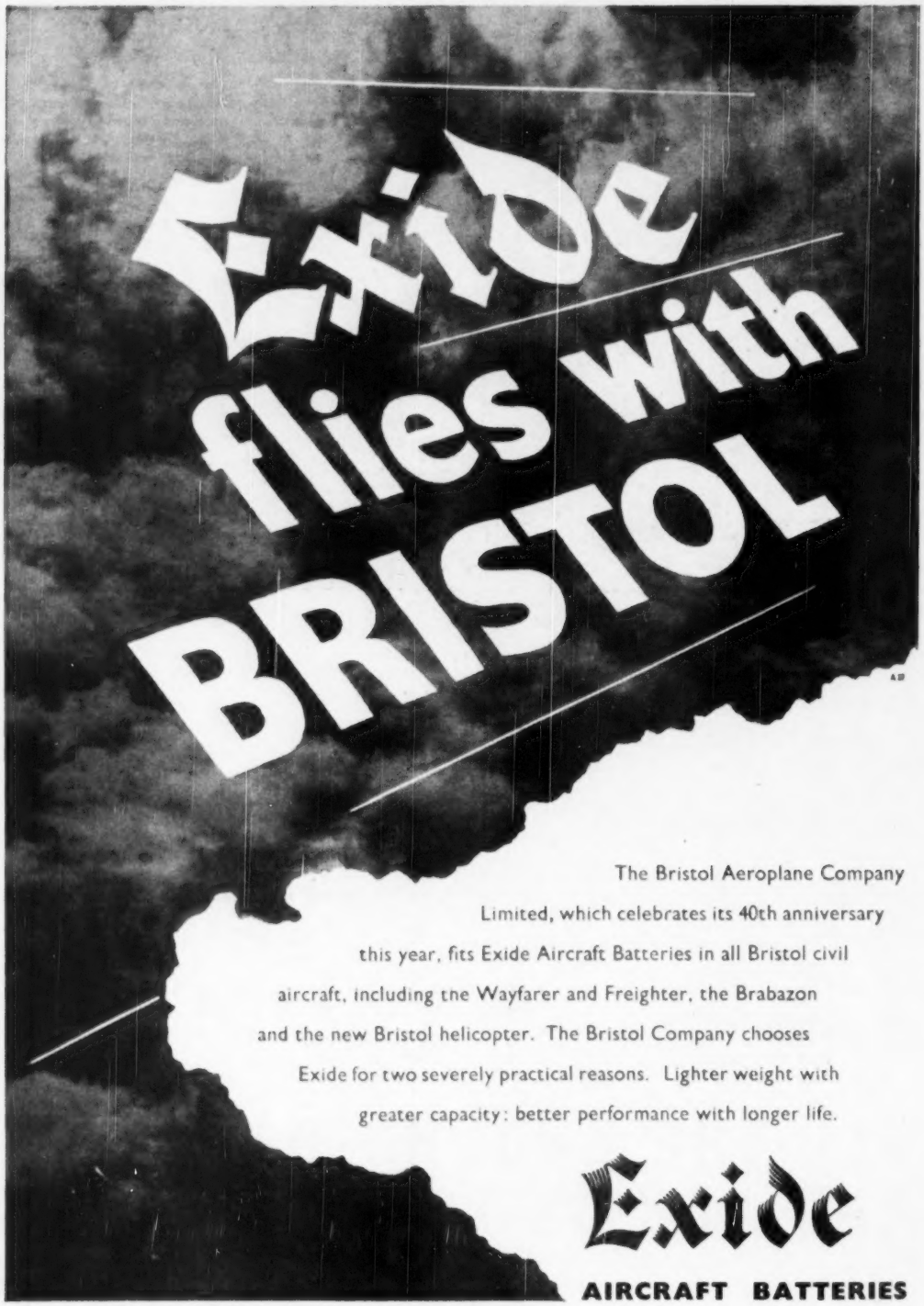
FOLLAND AIRCRAFT LTD

DESIGNED AND CONSTRUCTED

all the control surfaces, ailerons, elevators, flaps and rudder, and now at our Hamble works we are playing a further important part in this great British enterprise by designing and building

ALL THE GROUND-HANDLING AND SERVICING EQUIPMENT

for the "Bristol" BRABAZON



The Bristol Aeroplane Company Limited, which celebrates its 40th anniversary this year, fits Exide Aircraft Batteries in all Bristol civil aircraft, including the Wayfarer and Freighter, the Brabazon and the new Bristol helicopter. The Bristol Company chooses Exide for two severely practical reasons. Lighter weight with greater capacity: better performance with longer life.

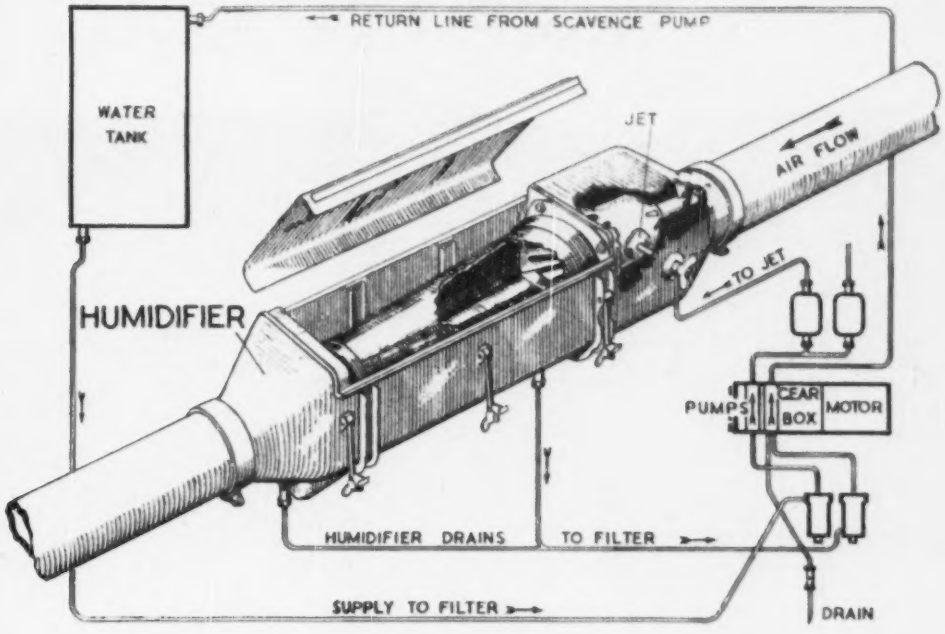
Exide

AIRCRAFT BATTERIES

A PRODUCT OF CHLORIDE BATTERIES LIMITED, EXIDE WORKS, CLIFTON JUNCTION, NEAR MANCHESTER

CABIN ATMOSPHERE CONTROL

CABIN HUMIDIFICATION



The Normalair Humidifier provides a means of increasing the moisture content of the air received into the cabin atmosphere control system and so obviates the discomforts and the dangers to health that can be caused by the action of the excessively dry air existing at high altitudes.

Each individual humidifier unit consists of a rectangular body with an easily detachable lid. Supply air is directed through the body, which contains the necessary jet and filter assemblies. Depending on the aircraft capacity, humidifiers can be employed singly or in banks of two or more arranged in parallel formation in a common casing. They are normally located in the fuselage ducting just downstream of the heating and refrigeration equipment. Humidifiers are used in conjunction with a separate pump and accessory unit which provides, in a single compact container, the accessories required for efficient operation of the humidifier.

The main component of the accessories unit is a duplex hydraulic pump driven by an electric motor. Also included are delivery and scavenge filters; solenoid valves to control the passage of water to humidifier jets; a thermal switch to prevent the pump motor being started if the temperature of the accessory components is below 40° F; and a suppressor and relay switch for the electric motor circuit. The accessory unit can be controlled automatically by a humidistat or by a hand operated switch.

NORMALAIR LTD

YEOVIL ENGLAND

Designers and Manufacturers of Air Control Equipment

Precision in Perspective

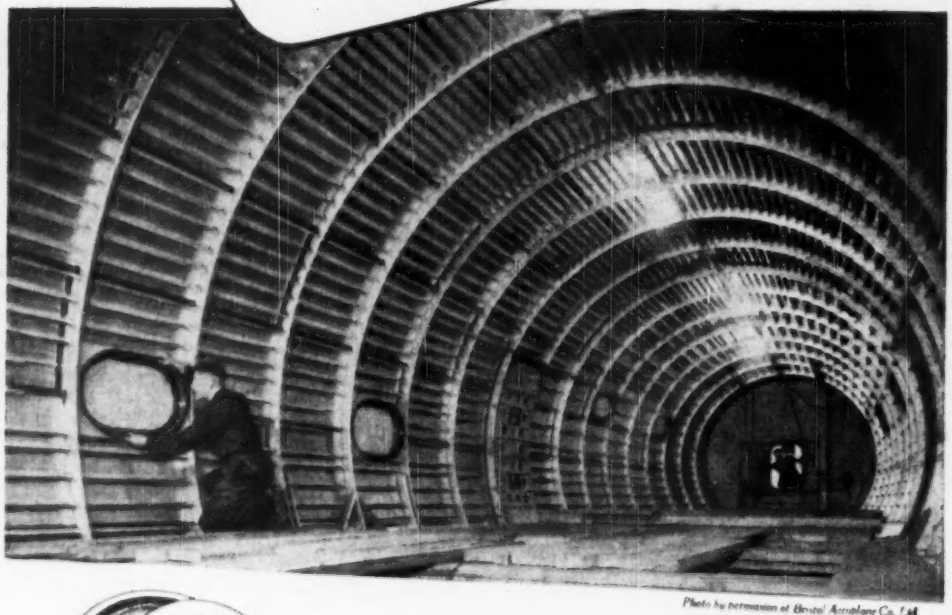
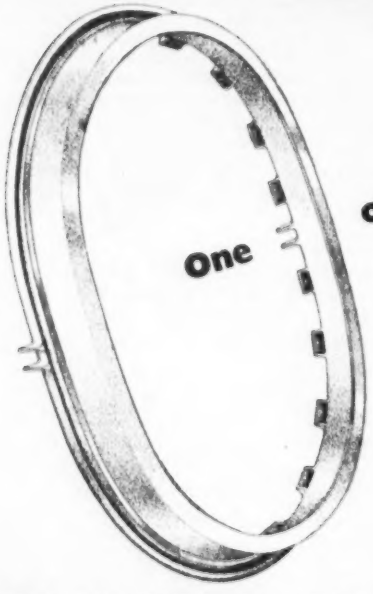


Photo by permission of Bristol Aeroplane Co. Ltd.



One of the efforts for the Mighty 'BRAB'

The pressurised windows and door frames for the Bristol "Brabazon" were the combined design effort of the Bristol Aeroplane Co. Ltd. and our own design section and were fabricated in our works. A high technical skill and precision was required to ensure a perfect seal and accurate mating with the fuselage.

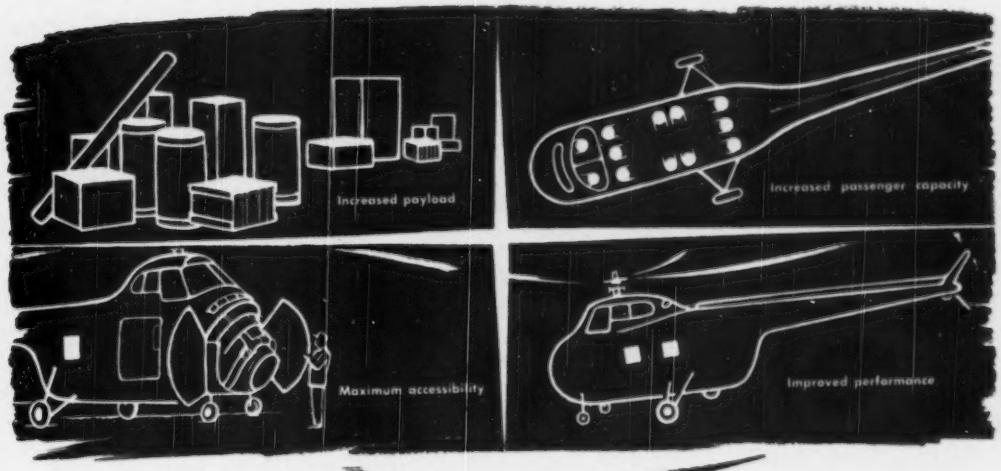
The excellent machining and weldable properties of MAGNESIUM make it the ideal structural metal. Its use in these relatively large components of intricate sections is a valuable contribution to weight saving on this aircraft.

ANOTHER TRIUMPH FOR

A *Magnesium* product

ESSEX AERO LTD. SPECIALISTS IN MAGNESIUM THE AIRPORT GRAVESEND · KENT

Announcing a NEW SIKORSKY HELICOPTER



the S-55

Sikorsky Aircraft announces the acceptance of its new 12-place helicopter by the United States Air Force.

The commercial version of this aircraft, designated the S-55, carries more than twice the payload of previous models. This latest Sikorsky helicopter combines many important advances in performance, dependability, maintenance and ease of handling on the ground and in the air.

UNITED AIRCRAFT
Export Corporation

EAST HARTFORD, CONNECTICUT, U.S.A.

European Office: 4 rue Montagne du Parc, Brussels, Belgium

PRATT & WHITNEY ENGINES	HAMILTON STANDARD PROPELLERS	CHANCE VOUGHT AIRPLANES	SIKORSKY HELICOPTERS

A*

Factory in the Valley . . .

We knew what we wanted—and so did the architect. Space in the workshops, the elbow room that good factory layout demands. Modern architectural design, extensive Research Laboratories with facilities and equipment for testing on quite an ambitious scale. And, of course, all the smaller, sensible things that help to attract and keep work-people happy. We were lucky in our choice of site. Good people to work with, coal almost underfoot, water, good roads—all present and correct in that South Wales Valley.

And so there grew at Treforest the largest and, we believe, best planned factory in Europe for producing fasteners, aircraft, industrial and marine gauges, oil-cleaners and nuts. Yes, nuts. And that is no anti-climax. For when we talk of making nuts we mean making many millions of nuts a year.

SIMMONDS AEROCESSORIES LTD

SIMMONDS AEROCESSORIES LTD · TREFOREST · GLAMORGAN ALSO MELBOURNE · AUSTRALIA

23

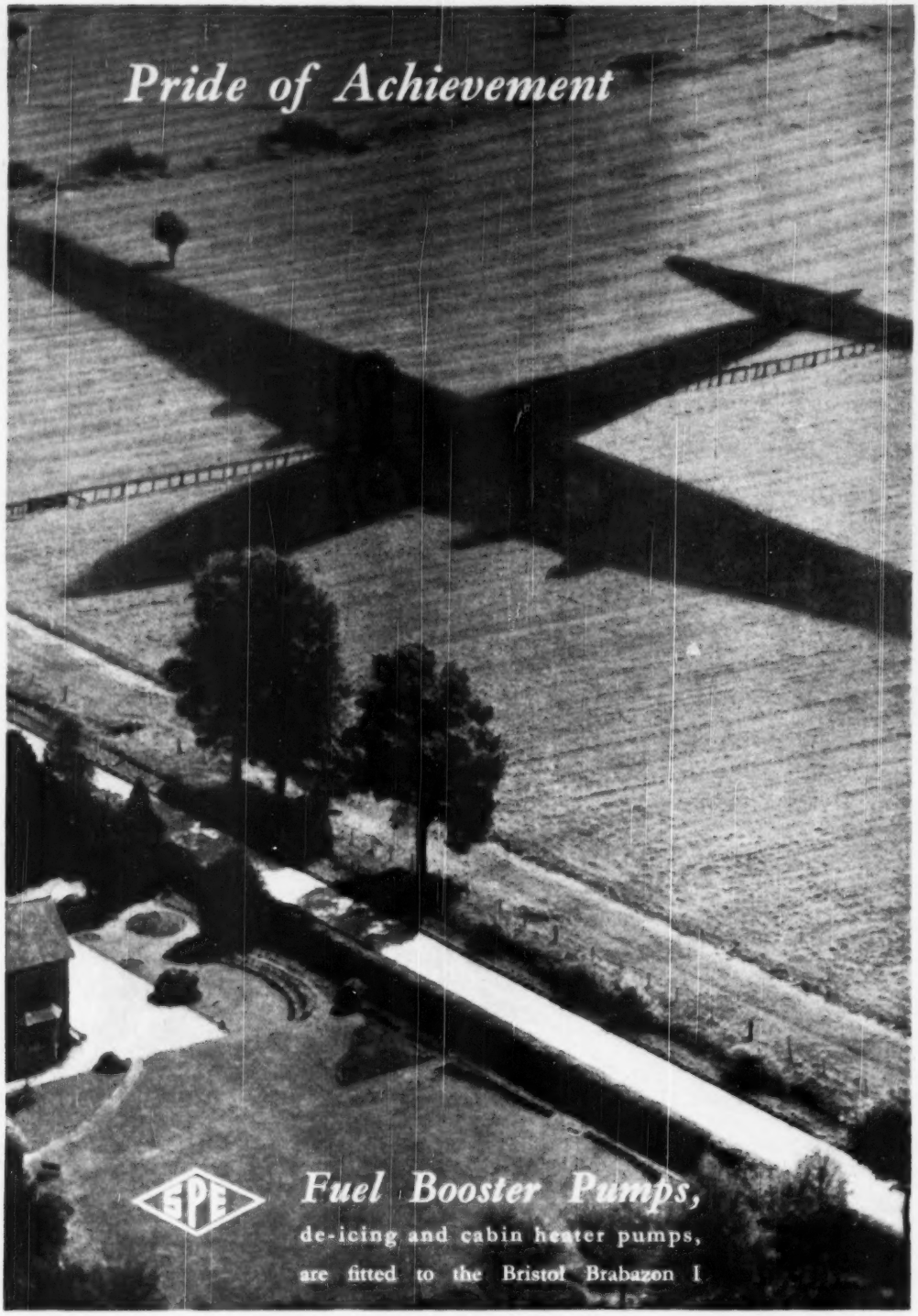
Link with the Future

Present day design advances so swiftly that only the aircraft that is ahead of its time can hope to stay in the forefront. That is why Sperry Flight instruments are designed with an eye on tomorrow—designed to solve in advance instrumentation problems for aircraft operating at the longer ranges, higher speeds and altitudes that the future holds in store.

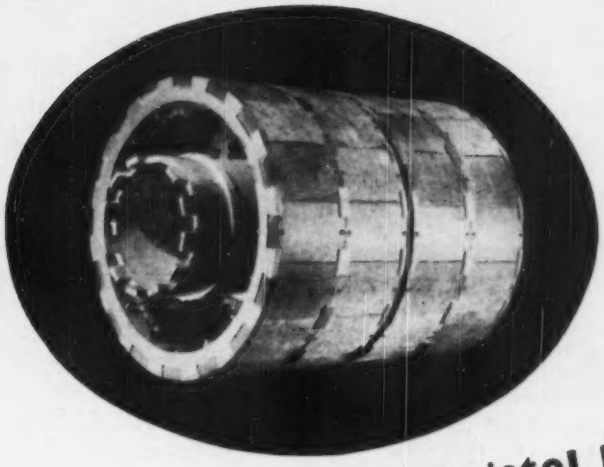
SPERRY

Instruments that inspire confidence

THE SPERRY GYROSCOPE COMPANY LIMITED
GREAT WEST ROAD · BRENTFORD · MIDDLESEX



SELF-PRIMING PUMP & ENGINEERING CO LTD TRADING ESTATE SLOUGH BUCKS



Mintex on the Bristol Brabazon

As suppliers of the brake liners fitted to every British Aircraft which took part in the Battle of Britain and, in fact, to practically all British Aircraft constructed in recent times, we are proud of our association with the Industry.

Mintex brake liners have been supplied in large numbers as original equipment for many famous products of the Bristol Aeroplane Company Ltd. including the Beaufort, the Beaufighter, the Blenheim, and the Brigand, to say nothing of the Brabazon.

A complete Brabazon brake assembly as developed and made by Dunlop and fitted with Mintex liners is shown above.

Over 1,000,000 Mintex supercharger clutch discs were supplied for the famous Hercules engines and many thousands have been fitted to Centaurus engines. All Centaurus discs are cemented to metal plates by a special Mintex process.

On the occasion of their 40th Anniversary we send our congratulations to a company which we have been privileged to serve on such a scale and for a long period of time.

MINTEX

MINTEX BRAKE AND CLUTCH LINERS AND OTHER FRICTION MATERIALS ARE MANUFACTURED AT CLECKHEATON YORKSHIRE BY BRITISH BELTING AND ASBESTOS LIMITED

BBA

EVERSHED POSITION CONTROLLERS

Evershed & Vignoles Ltd., offer their congratulations to the Bristol Aeroplane Co. Ltd. Evershed Position Controllers were installed in the Bristol Brabazon I, the first aircraft to fly with all-electric throttle and propeller pitch controls.

Write for further details of the controllers in Publication FT. 220

EVERSHED & VIGNOLES LIMITED · LONDON W.4

TELEPHONE : CHISWICK 3670 · TELEGRAMS : MEGGER · CHISK, LONDON

'LASSOVIC'

SELF ADHESIVE TAPE

The fact that 'LASSOVIC' self-adhesive tape was specified in the production of the "Bristol" Brabazon is yet another proof of its excellence. Made on a base of Plasticised Polyvinyl Chloride, it is a tape of outstanding interest to the electrical industry. Not only has it good electrical properties, but it is protective against oil, water, acids and corrosive substances.

These qualities make it an ideal tape for such work as binding cable harnesses, splicing and insulating in junction boxes and coil wrapping; it is especially valuable when the job has to withstand oily or damp conditions. The range of colours provides identification as well as protection and the extreme pliability enables it to fit snugly round irregular shapes and do many awkward jobs.

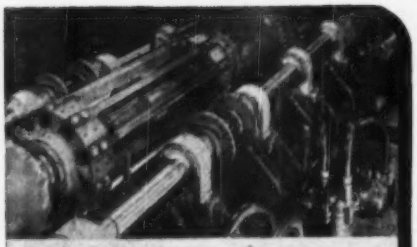
(9)

LASSO PRODUCTS (PROPRIETORS, HERTS PHARMACEUTICALS LTD.)

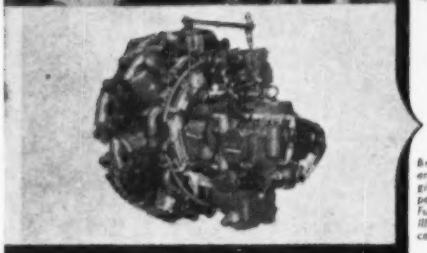
WELWYN GARDEN CITY, ENGLAND. Phone: Welwyn Garden 3333

- Solents are the first British civil aircraft in actual service which meet the standards laid down by I.C.A.O.
- The Solent will carry 44 passengers in safety and comfort 1,350 miles over the Tasman Sea.
- Tasman fares are among the lowest in the world, yet they have operated profitably since 1940 using Short flying boats.

The first manufacturers of aircraft in the world



Five Vokes Lubricating Filters are fitted to the coupled Proteus test rig.



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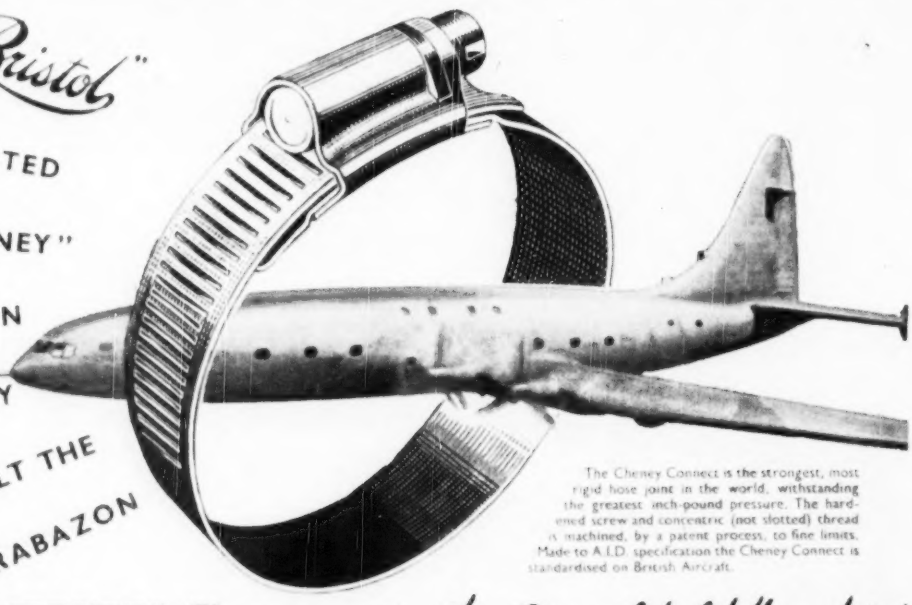

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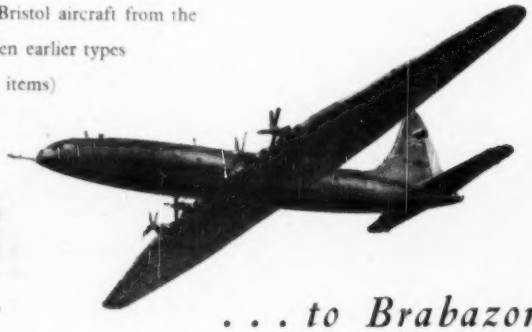

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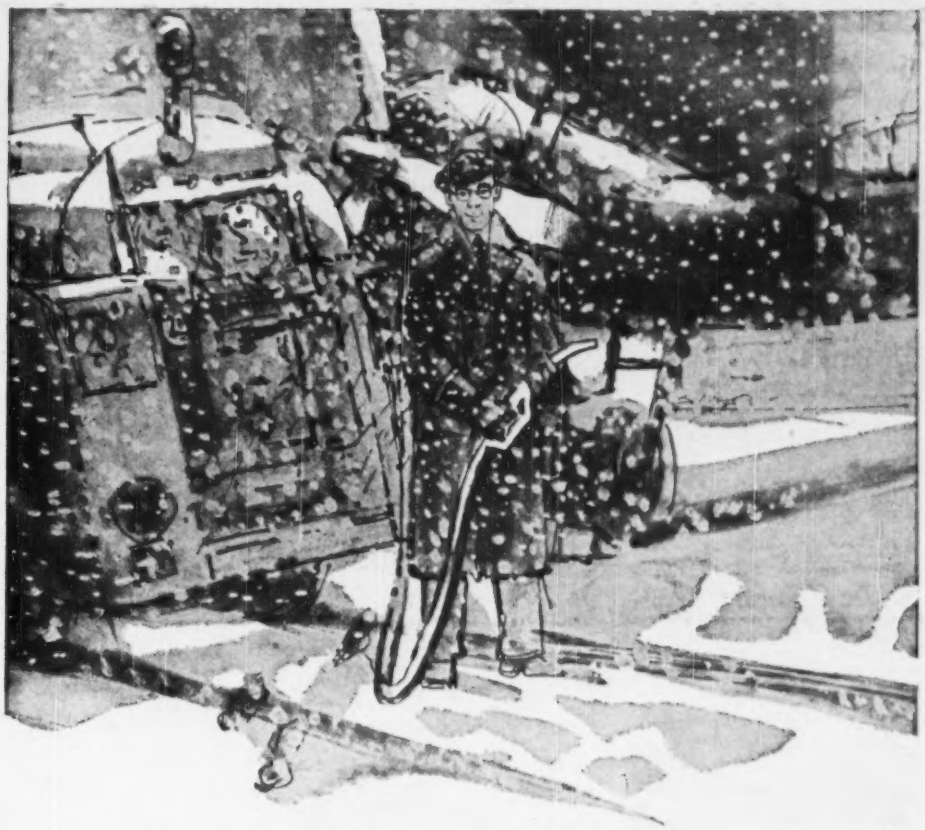

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No. 2147 Vol. LVII. THURSDAY, 16 FEBRUARY 1950

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Perilous Policy

IN recent weeks there have been disquieting reports, some unconfirmed, others official, of the cancellation of orders and consequent threat of a further reduction in the numbers employed in the aircraft industry. Unfortunately there is ground for real concern, not only over the curtailment of existing contracts but also about the dearth of new orders with which many companies are confronted. Cuts in national expenditure were ordered some time ago, and it was clear that these would affect, among other things, the Service estimates. In turn, the amount of money available for the purchase of aircraft had necessarily to be reduced.

It is not irrelevant to mention that in the aircraft industry, as in all others, one perforce gets less for one's money nowadays. It is an amazing but true fact that a modern military aircraft, with all its complexity, may cost up to ten times as much as its pre-war counterpart. A given sum of money, therefore, cannot be stretched to cover as many orders, or benefit as many companies.

Though accepting that all sorts of painful economies must be made at this time, *Flight* is deeply concerned lest the tempo of the aircraft industry be allowed to slow down to such an extent that full recovery be rendered impossible, or, at best, a dangerously protracted procedure. This must be prevented at any cost, for the country is vitally dependent upon its air strength and productive capacity for its national security.

An appropriate simile is afforded by the gas turbine. For starting, it requires the application of considerable and sustained power; below a certain speed it is not even self-supporting; even when approaching half its maximum r.p.m. it burns fuel but gives very little thrust in return, and, moreover, is slow to accelerate. Only when running at higher r.p.m. and making forward progress does it display its true power and flexibility. In much the same way the aircraft industry must be maintained at a tempo which will permit a rapid pick-up to maximum production in emergency, and at which it is able to show an output economical in relation to its consumption. Slow development and production, due to lack of manpower and money, can prove fatal to the prospects of a new aircraft.

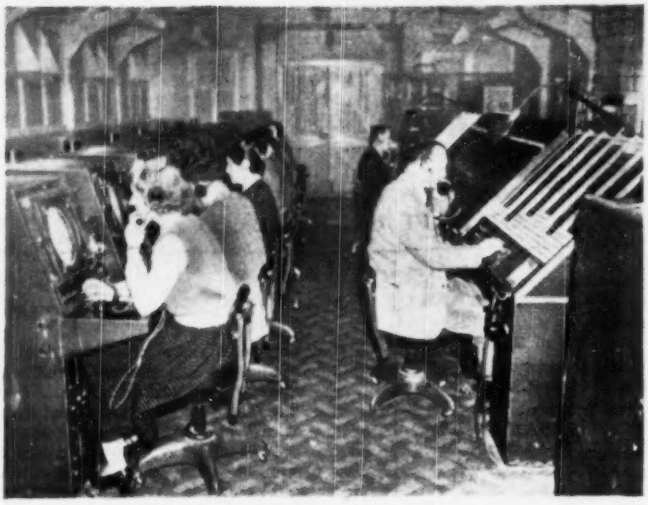
The industry itself may not be entirely blameless. While British technical ability remains second to none, there are those who have sensed some lack of vitality and enterprise, and even of cohesion, in certain of the individual companies. Fears have also been expressed that too little has been seen in the way of results for the very considerable outlay on research and development since the war.

There are even broader issues at stake. It is understandable that the re-equipment of several R.A.F. bomber squadrons with American aircraft at this time should give rise to caustic comment from the industry, in spite of the fact that the reasons which have prompted such action have been explained. The current delivery of several million dollars' worth of Stratocruisers rubs salt into the wound, for it is felt that more foresight in planning might have enabled a British airliner to take the place of these belated arrivals. The continued friendly encroachment of the American aircraft industry upon our preserves can have the most far-reaching and ultimately disastrous effect of eventually crowding-out British products. American airliners and American bombers (with their special American equipment, flow of spares, and associated servicing methods) might conceivably have to be followed by more American military transports to bolster up a skeleton of a Transport Command.

Our aircraft needs could have been met by our own industry had it been given the opportunity. It is imperative that, in the future, British manufacturers—who are now able to employ only one-twelfth of the man-power required for wartime production—should supply all the country's aircraft needs. We may add, also, that the zeal to export military aircraft, admirable in itself, should not be allowed to prejudice the re-equipment of our own fighter squadrons.

LONDON RADAR

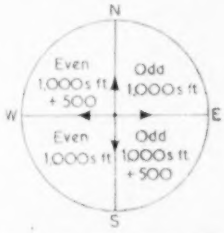
Long-range Radar Monitoring Service Centred at London Airport : First of its Kind in the World



Along one wall of the control room is arranged a battery of eight P.P.I. consoles, and the controllers sit at their specially designed desks back to back with the P.P.I. operators.

THE fact that the initial concept of radar was British, and that our pioneer work in this branch of electro-physical science was the cardinal factor of our successful defence during the early days of the war, makes it particularly fitting that we should again be the leaders in a field of radar application which promises to be of first importance in civil aviation. On February 22nd the long-range radar unit which is to be known as "London Radar" will go into operation, and it will be the first service of its kind in the world to become an integral element of routine airline operation.

At the present time, the air space over this country is divided into five Flight Information Regions (F.I.R.s) within each of which, around the terminal airports, there exist busy areas which are defined by law and are known as Control Zones; all aircraft operating within the Control Zone boundaries are provided with traffic separation and flight information. International regulations lay down that, when flying in F.I.R.s in bad weather, aircraft must observe the "quadrantal rule" (see diagram), whereby the height of each aircraft varies according to its heading. Within the F.I.R.s the quadrantal rule is supplemented by a traffic-control service known as Informative Control. Aircraft using this service are required to report their position regularly, so that their proposed flight path can be co-ordinated with those of all other aircraft known to the Air Traffic Controller.



Explanatory diagram of the Quadrantal Rule. Height is governed by heading; for example, an aircraft flying on a heading of 80 deg would be at an odd-thousand-ft altitude, whilst one heading 260 deg would be flying at an even-thousand plus 500ft altitude.

The twin parabolic-section aerials mounted at the top of their 25-ft tower rotate at a speed of four revolutions per minute.

The Informative Control service is, however, purely voluntary and, therefore, the efficiency of traffic co-ordination is dependent upon the number of aircraft voluntarily reporting. The Air Traffic Control Centre at Uxbridge provides at the moment an informative control service for all aircraft within the south-eastern F.I.R. and for all aircraft at an altitude above 5,000ft in the south-western F.I.R.

The inauguration of the long-range radar unit at London Airport will augment the existing control service from Uxbridge, and it is intended that the flight plans of aircraft using the informative service will be co-ordinated, not only for those aircraft who declare their proposed flight plans to Uxbridge, but for all aircraft visible on the radar screens. The area covered by London Radar varies according to the height at which an aircraft is flying, and according to the individual size of aircraft, but in approximate terms, the coverage can be quoted as :—

Height (feet)	Radius of coverage (nautical miles) Single-engined a/c.	Four-engined a/c.
2,000	28	37
5,000	47	59
10,000	71	89
20,000	93	132

As an additional safety measure it is proposed that, where possible, aircraft able to communicate with the

radar controller will not only have their flight plans co-ordinated, but will have their progress continuously monitored for so long as they remain within radar cover. Although the new radar unit is essentially long-range in character and will, therefore, concentrate on aircraft flying outside the Metropolitan Control Zone, it will also work in direct contact with the G.C.A. installations at London Airport and Northolt. By this means, when captains of incoming aircraft so desire, arrangements can be made for them to be handed on direct to G.C.A. control at intervals so spaced as to give the optimum attainable landing rate.

It should be emphasized that London Radar is not a navigational guide and pilots are expected to navigate themselves without aid from the service. Nevertheless, when a captain so desires, radar guidance can be supplied; for example, if a check on position is required, it will be given on request—provided, of course, that the aircraft has been previously identified. It is to the benefit of every aircraft that, having entered the area of radar coverage, it should at once apply for information control; thus, after it has been identified, it can proceed in co-ordination with the movements of other aircraft in the area.

Avoiding Service

Over and above the advantage given in regard to smoothing-out inequalities in landing rates and so forth, an important factor of safety is also involved. The very fact that virtually the whole of south-east England is subjected to continuous radar surveillance necessarily means that any extraneous aircraft such, for example, as Service and private types operating in the area, appear on the London Radar screens and, therefore, warning information can be given to any aircraft in communication with London Radar of the existence of other aircraft in the immediate vicinity and, if necessary, avoiding action directions can be issued. The value of such a service as this does not need emphasis.

Another, but quite different, safety measure is also made available by the unit. The type of radar equipment used shows the position of areas of heavy precipitation. Pilots can, therefore, be warned of severe frontal weather and cumulo cloud areas, and can be given courses to fly that avoid them.

The captain of an aircraft to be handed over to the control of London Radar will be advised by Air Traffic Control, Uxbridge, of the frequency to be used and will be given a specific time, place and/or height at which to change frequency. The frequencies on which the service will be available are: 118.3, 119.1, 119.9, 123.5 and 126.18 mc/s. The 119.1 mc/s frequency is also used as a supplementary approach-control frequency at London Airport, and the two frequencies 123.5 and 126.18 mc/s will remain available only until July 1st, 1950. In addition, frequencies of 118.1 and 122.1 mc/s may be used in emergency or at off-peak traffic periods at the discretion of Air Traffic Control. The whole efficiency of the service is, of course, dependent upon the quality of communication between the unit and aircraft, and in this connection a high-quality V.H.F. R/T system has been installed, the reception qualities of which are said to rival those of the B.B.C.

A V.H.F. cathode-ray direction-finder is used to assist in the identification of individual aircraft.

The R/T phraseology (the English language will be used in all R/T communication) employed by London Radar will vary according to differing circumstances, but the following example is typical of the phraseology which will be adhered to as closely as possible:—

Aircraft: "London Radar, this is Gemini George Able Fox Love Tare."*

London Radar: "Gemini George Able Fox Love Tare, London Radar. Over."

A/c.: "London Radar, Gemini Love Tare abeam Manston, 8,000ft, heading 270 deg, IFR. Over."

L.R.: "Gemini Love Tare, for identification turn left, heading 210 deg for one minute, then return to original heading. Advise. Over."

A/c.: "Love Tare, heading 210 deg now."
[Pause.] "Love Tare, heading 270 deg. Over."

L.R.: "Love Tare, you are identified. QDM 275 to Gravesend, 35 nautical miles. Over."

A/c.: "Roger."

L.R. [*after giving London Airport weather in "Q" code—visibility, cloud-base, altimeter setting, surface wind, etc.*]: "Runway 28, descend to 4,000ft and advise. Over."

A/c.: "Gemini Love Tare at 4,000ft. I require G.C.A. Over."

L.R. [*if necessary*]: "Turn right [or left], heading . . . deg. This is avoiding action. Over."

A/c.: "Love Tare now heading . . . deg."

L.R.: "Love Tare, turn left [or right], heading . . . deg. You are clear of traffic, 10 miles to Gravesend."

A/c.: "Gemini Love Tare over Gravesend."

L.R.: "Roger, continue homing to London."

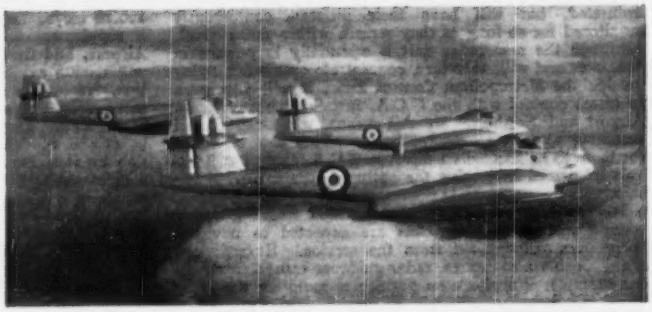
A/c.: "Gemini Love Tare, now heading 290 deg."

L.R.: "Love Tare, you are now 23 nautical miles from London, QDR 110. Listen-out on this frequency for London G.C.A. director."

Height indication is given by means of separate equipment.

* *An airliner would identify itself by its registration letters, or trip number, prefixed by the company call sign (e.g., "Bealine" for B.E.A. and "Speedbird" for B.O.A.C.).*

HERE and THERE



THREE EIGHTS: The Gloster photographer recently secured this formation shot of three of the new Meteor 8 fighters, flown by the firm's test pilots. This latest Meteor single-seater development, which is not yet in squadron service, differs from the Mk. 4 in the design of nose, tail and cockpit enclosure.

R.A.F. Display Date Changed

A FORTNIGHT ago the revival of the Royal Air Force Display was announced. The Air Ministry now states that the proposed date has been put forward a week—to Friday and Saturday, July 7th and 8th. Their Majesties the King and Queen have consented to attend on the Friday.

Air Ministry Please Copy

THE Canadian de Havilland Company is reported to be discussing with the R.C.A.F. a plan by which fifty Chipmunks will be purchased and put at the disposal of the Dominion's flying clubs.

Rocket Film

THE next programme in the Royal Aero Club's winter session of film shows at Londonderry House will be at 6.15 p.m. on Tuesday next, February 21st, when a Ministry of Supply film, *The Development of Rocket Flight*, will be shown. The three final shows in the series will be given on March 13th and April 4th and 25th. Invitations are obtainable through members.

Hawker Headlines

IT is reported from Australia that negotiations are in hand with Hawker Aircraft, Ltd., as a result of which "Australia may manufacture the most advanced type of jet-propelled interceptor fighter equipped with Rolls-Royce engine."

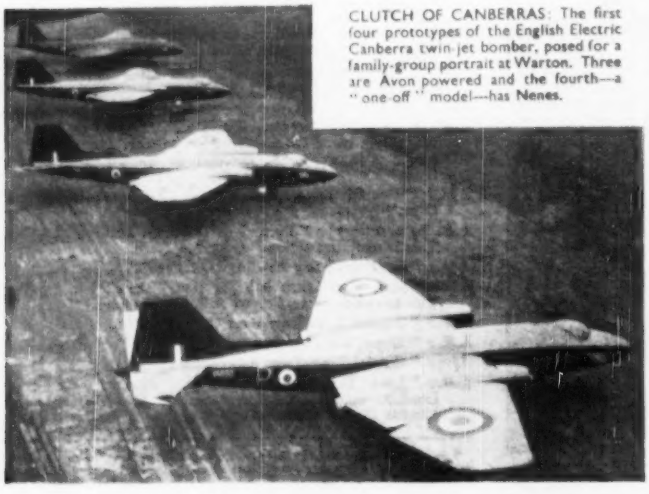
Invited to comment on this report, Hawker Aircraft say that negotiations have been, and are, going on for production of "a version of the P.1052," but they are unable to divulge further information at this stage. Following the rumoured Australian production of the Tay—newest of the Rolls-Royce turbo-jets on which information has been released—it may be assumed that this unit will figure in the P.1052.

Two other items of Hawker news are that to-day (February 16th) S/L. Neville Duke is to attempt to establish a place-to-place record, in a standard Fury, from London to Cairo; and that the expected move of the company's works and airfield to Squire's Gate, Blackpool, has (in view of the altered prospects of future aircraft orders) been cancelled—though the problem of having to vacate Langley (which is near London Airport) remains unsolved.

Neptune's New Record

A LOCKHEED P2V Neptune patrol-bomber is reported to have set up an unofficial distance record for a carrier-based aircraft on February 7th-8th. Flown from a carrier off the Florida coast, and with a crew of seven, it covered 5,060 miles in 25 hr 59mn to San Francisco municipal airport.

The previous best carrier flight—also by a Neptune—was one of 4,803 miles (25 hr 42 min) made last autumn, and earlier in the year one had taken off from a flight-deck at an all-up weight of 74,000 lb. The famous P2V *Truculent Turtle* still holds the world's long-distance record with a flight of 11,237 miles made in September, 1946.



CLUTCH OF CANBERRAS: The first four prototypes of the English Electric Canberra twin-jet bomber, posed for a family-group portrait at Warton. Three are Avon powered and the fourth—a "one-off" model—has Nenes.

Bomber Command Night

APPLICATIONS for tickets (5s) for this year's Bomber Command Night, to be held at the Royal Albert Hall, London, on Friday, May 19th, should now be made. Members of the R.A.F. Association should apply to their local branches and all other applications should be sent (with stamped addressed envelopes) to the Pathfinder Association, 115, Mount Street, London W.1. The reunion is again being sponsored by the London *Evening News* with the co-operation of the Air Ministry the R.A.F. Association and the Pathfinder Association.

Eyes of the Ship

THE R.A.F. flight attached to the Norwegian-British-Swedish Expedition to Queen Maud Land, Antarctica, has already performed valuable reconnaissance duties with its two Auster 6s. Several sorties were made early this month by S/L. G. B. Walford and F/L. H. M. H. Tudor, in one case with a Norwegian officer of the survey-ship *Norsel* on board. On each flight valuable information was obtained as to the extent of the ice-barrier near Cape Norvegia.

Unprogressive

SPEAKING at the recent annual dinner of the Royal Aeronautical Society (Southern Africa Division), the president, Maj. R. A. Powell, said that aeronautical engineering in the Union was going back instead of progressing. This, he said, was in direct contrast to the spectacular development of aircraft manufacturing in other Dominions. Many of the men whose knowledge of aircraft production had been invaluable during the war were now retiring, and few younger men were coming forward

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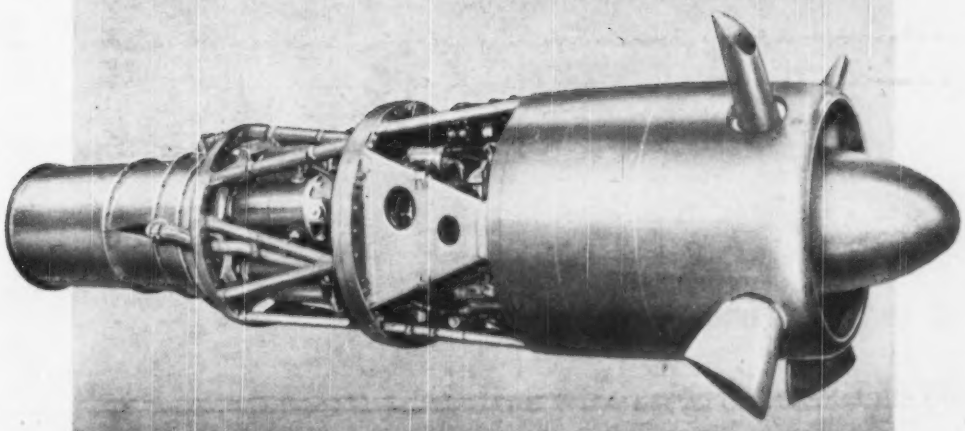

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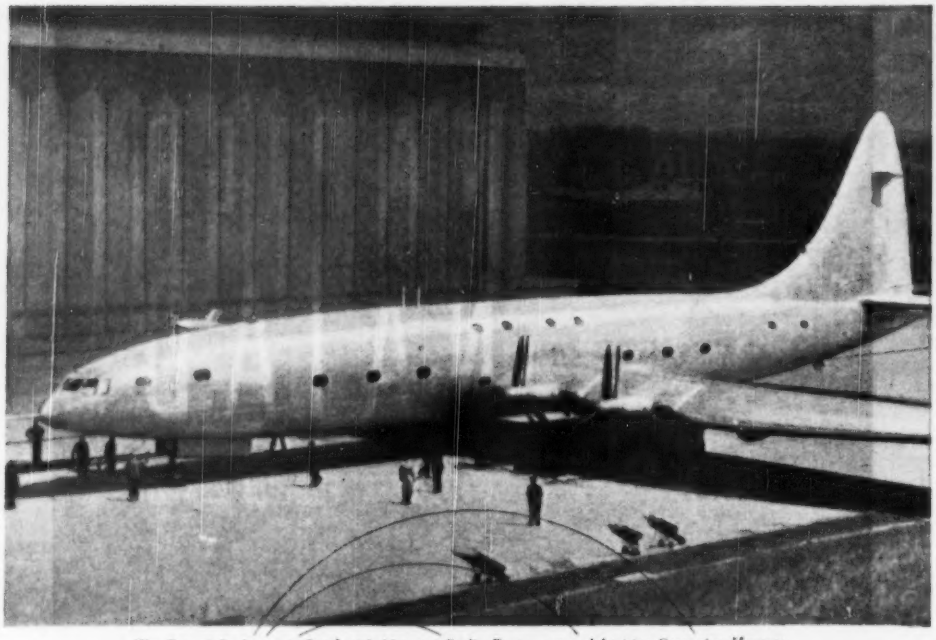
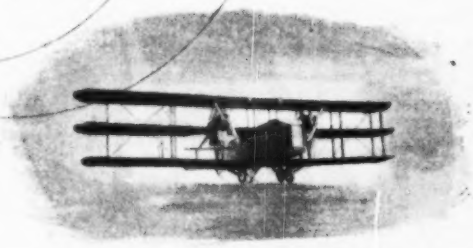


The Bristol Brabazon is fitted with Marconi Radio Equipment and Ignition Screening Harness

Linked by Marconi communications equipment



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HERE AND THERE . . .

to replace them. The universities had not the staff to undertake aeronautical-training curricula, though Prof. Walker at Witwatersrand was doing his best.

When it had been possible to send young men to Britain for training, added Maj. Powell, they had invariably done well, and one of them had achieved the distinction of winning the Mitchell Memorial Scholarship.

All But There

AN attempt to fly from Australia to London by easy stages ended almost within sight of the goal on February 6th, when Mr. George Michaelov had to force-land his Anson near Horsmonden, Kent, following engine-trouble over the Channel. He left Sydney last December.

After 31 Years

WHAT must easily be a record in long-term wreckage-identification is reported from Argentina, where the remains of an aircraft found in the Andes have been identified as those of a Nieuport machine which disappeared during one of the pioneer flights made over the range in 1919.

Ramjet Investigation

A TEST chamber for jet units—especially ramjets—capable of simulating flight speeds of up to 2,600 m.p.h., has been built by the Wright Aeronautical Corporation as part of their multi-million-dollar laboratory at Wood Ridge, New Jersey. The U.S.A.F. is known to have ramjets under consideration as a source of power for guided missiles and pilotless aircraft, and the new test chamber will provide operational data which have been unobtainable by existing methods of research.

NO TOY: This splendid Dakota model (11ft span, 15 lb a.u.w.), powered by two petrol engines developing 1.4 h.p. together, is the work of Mr. Fred Borders of Brixton, London. It is designed for radio control, and Mr. Borders intends to send it on a cross-Channel flight—which suggests plenty of confidence in its reliability.

NEWS IN BRIEF

DURING his recent visit to Canada (see photograph below) Sir Roy Dobson said that the Avro Canada C-102 would fly the Atlantic next year in order to appear at the S.B.A.C. Show.

* * *

This year's British Industries Fair will take place from May 8th to 19th; the engineering section will, as usual, be at Castle Bromwich, Birmingham.

The Department of Scientific and Industrial Research draws attention to an important treatise on "recommended methods for the electroplating of steel springs," prepared by the Coil Spring Federation Research Organization, 301, Glossop Road, Sheffield, 10.

FIRE FIGHTER: "Heath Robinson" crash tenders are things of the past. As efficient in action as it is handsome in appearance, the latest Pyrene tender (above) can, it is claimed, deliver 3,500 gall of foam and 2,400 cu ft of CO_2 gas in 90 sec.

ORENDA UPENDED: Sir Roy Dobson, managing director of A. V. Roe and president of the Canadian Company, recently visited Malton and saw the Orenda turbojet. On the left is Mr. Walter N. Deisher, general manager. Orendas (in the 6,000 lb-thrust class) will later power Avro Canada C^5-100 fighters. The prototype flew recently with Avons.

* * *

Wolf Electric Tools, Ltd., of Hanger Lane, London, W.5, hitherto well-known as manufacturers of portable electric drills, have now produced a range of six electric soldering-irons for industrial use.

* * *

Aircraft constructors in Britain, America, Belgium, Czechoslovakia, Turkey and Holland have signified their intention of taking part in the Brussels Aero Show and Flying Displays from June 10th to 25th.

* * *

The administrative offices of Automobile and Aircraft Services, Ltd., are now at 48, Brook Street, London, W.1 (Mayfair 3747) where all matters concerning the aircraft side of the business will now be handled.

* * *

During recent years the Exactor Control Co., Ltd., has extended its range of products to include self-sealing pipe couplings, fuel-flow test rigs, and other items; it has therefore been decided to change the company's title to one of less restricted character—Exactor, Ltd. The address, 108, Park Street, London, W.1 (Mayfair 0252) remains unchanged.

PRODUCING A PROTOTYPE

An Examination and Evaluation of the Art : Mr. C. T. Wilkins's R.Ae.S. Lecture

ON Thursday last, February 9th, a Paper, entitled *The Producing of a Prototype Aircraft*, was presented before the Royal Aeronautical Society by Mr. C. T. Wilkins, A.F.R.Ae.S., assistant chief designer to the de Havilland Aircraft Co., Ltd.

Mr. Wilkins started by saying that, broadly speaking, there were two kinds of prototypes: (i) the research aircraft with which to obtain specific data for a future production aircraft, and (ii) the first of a production order. If the project was in the first category, then it was right to build one or two aircraft only; but if it was in the second, production aircraft should be built as near concurrently with the prototype as was possible.

An aircraft for production should represent a large enough advance in design to reach a potential market and, by development, to hold that market for many years. It should, however, not be so radical in conception as to make it unwise to proceed with quantity production without test-flying a prototype.

The lecturer thought that too many aircraft were built first as one or two prototypes, taking possibly two years or more to build, followed by, perhaps, one year of test-flying and modification before production really got going. A further period of two years might elapse before the first production aircraft was delivered to the operator, who might spend a further year in proving flights before the aircraft reached operational service—making, say, six years from the time when the prototype was started.

This was far too long. During such a period, new developments in operational requirements, power plants, and so on, might take place which, if incorporated in the design, would cause still further delays; if they were not incorporated the aircraft would be obsolescent before it reached operational service. It was far better to face modification on the production line than to wait for prototype development, so that a batch of operational aircraft could be delivered to the operator at the earliest possible moment from which experience in actual operation could be obtained. In the meantime, the type could progress, incorporating any development and, also, any points which might arise from the operation of the delivered aircraft.

Time was the all-important factor in the producing of a prototype. There was nothing worse than a project which drifted on and on, repeatedly being altered until everyone was heartily sick of the whole thing, for it meant that enthusiasm flagged, the costs rose and the whole project suffered. Soon after the start of the design, a reasonable target date should be set for the first flight.

Value of Time

A meeting should be held periodically to keep a check on the progress of the job, to let people know what was going on in a general way, and to let people bring up any points, such as information required from the information department or stress office. Meetings and conferences generally, whether internal or external, should, nevertheless, be as infrequent, short and small as possible, for they could be shocking time-wasters.

The maximum possible amount of overtime should be worked, bearing in mind that, though overtime was costly in salaries, money was always saved by getting a job out quickly—owing, among other factors, to the reduced time for which overheads were being paid. Too-long hours should not be worked, and regular breaks in overtime should be provided, otherwise people would get stale and no benefit from overtime would result.

In order to keep down the number of men on the job, the drawings should be of the minimum standard required to build the prototype. To save time, as much information as possible should be put on one drawing. If, suggested Mr. Wilkins, the experimental department could build the aircraft from these drawings, so could the production department, provided that every item was dimensioned correctly and had a part number. When production really got going, these drawings would need to be broken down and made into proper production drawings in collaboration with the production department, and this would be the job of the production drawing office.

The modern aircraft had become so complicated that, if the present trend persisted, there was a danger that the aircraft would no longer be a practical flying machine but would become a box of tricks which spent most of its life on the ground being made serviceable. Simplicity was the keynote to reliability, ease of maintenance, lightness and cheapness.

Mr. Wilkins suggested that periodically the designer should stand back and ask himself: "Is everything incorporated in this design absolutely necessary? Are there any relics from a scheme which has since been altered? Is something still being done in a certain way because it suited a previous scheme?"

No new equipment should be accepted at its face value, but should be studied in detail and discussed with the manufacturers with a view to improving simplicity and lightness. The fact that the equipment had been used on some other type, although valuable in that experience had thus been gained with it, did not necessarily mean that it was suitable for the current type.

Without in any way detracting from the excellence of the work done by the S.B.A.C. Standards Panel, the lecturer believed that standard items should be confined to the smaller parts and that no attempt should be made to standardize things like controls, seats, and cockpit layout generally, as items of this kind were an integral part of the aircraft and should be designed as such. It was so difficult in the design of a successful modern aircraft to strike the exact balance of conflicting requirements, that any built-in compromises such as large standard items could not be afforded if the best possible design was to result.

Professional Status

In that section of his paper under the heading "Drawing Office," Mr. Wilkins made a plea that the whole occupation of aircraft design should be more on the basis of a profession such as, for example, that of an architect, rather than being considered as something between a trade and a profession. A good designer must first of all have enthusiasm for his job, a good technical knowledge, and an interest in aircraft generally. He must have sound basic mathematical and mechanical training followed by, or concurrently with, practical experience in the shops. There was, however, no need for him to be an artist. Many youngsters were put into drawing offices because they could draw; these were usually the people who remained draughtsmen all their lives.

Dealing with the work of the stress office, the lecturer stated that, in these days, when a modern aircraft structure presented probably the most difficult and refined structural problem of any branch of engineering in the world, so complex had the problems become that theory went only a certain way to achieve the optimum structure, and recourse had to be made to full-scale testing. It was important that this testing be done on the spot so that both designers and stressmen could watch the test in progress and reap the benefits of visual observation instead of merely reading a report.

Before the prototype had flown, a general programme of flight-testing should be prepared in conjunction with the chief designer and the aerodynamics department. It was important to obtain as early as possible an overall picture of the capabilities of the aircraft rather than to spend hours of test-flying in obtaining academic data which, useful as they might be, could be obtained at a later date. The important thing during the early test-flying was to keep the aircraft in the air.

The aim should be, assuming no major snags and with good organization, to average about one hour's flying per day for the first 100 hours of test-flying. Any important snags found should be reported immediately, and, if a good night shift was provided, these snags could be dealt with overnight.

The importance of the technical buying department in getting a prototype out quickly could not be over-emphasized. On its efficient working depended the avoidance of long delays in obtaining materials and proprietary equipment. Delivery dates of six months or more were often quoted for special materials. This could not be tolerated, and it was surprising what could be done to improve on these dates by bringing pressure to bear on the suppliers and refusing to take "no" for an answer.

To build a mock-up of the complete aircraft with wings and tail was, the lecturer thought, a waste of time and money. The location of the mock-up was important: ideally, it should be positioned facing large doors or windows so that a distant view might be obtained from the cockpit. It was most misleading when trying to assess the view to look at a blank wall. Everything in the cockpit should obviously be shown, even to the smallest items and, wherever possible, the actual equipment should be used. Paper dials representing instruments were useless.

SOME OUTSTANDING Bristol AERO ENGINE DIVISION ACHIEVEMENTS OF 1949

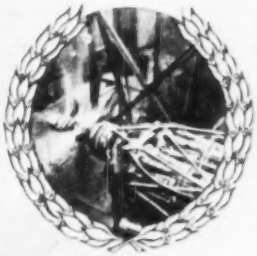
PHOEBUS
In February a Phoebus made its first flight, installed in the bomb-bay of a Lincoln.

CENTAURUS 18
In April a Centaurus 18 powered Hunter Fury broke the London-Rome record, previously held by a Vampire.

THESEUS
The Hermes 5 powered by four Theseus propeller-turbines made its first flight in August.

COUPLED CENTAURUS
This power unit completed its 150 hour type-test in April and flew in the Brabazon in September.

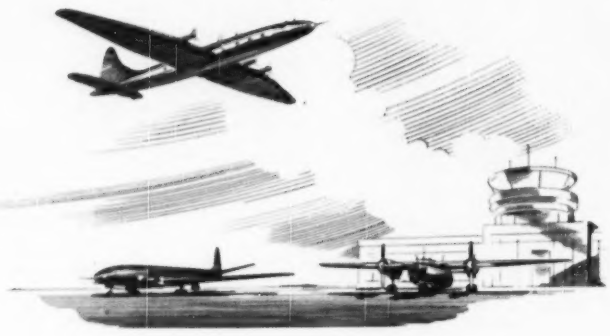
HERCULES 763
Hermes 4 production continued. Flight-tested in U.K. and Khartoum. Airworthiness trials nearing completion.



COUPLED PROTEUS
The coupled Proteus power unit ran for the first time in November.

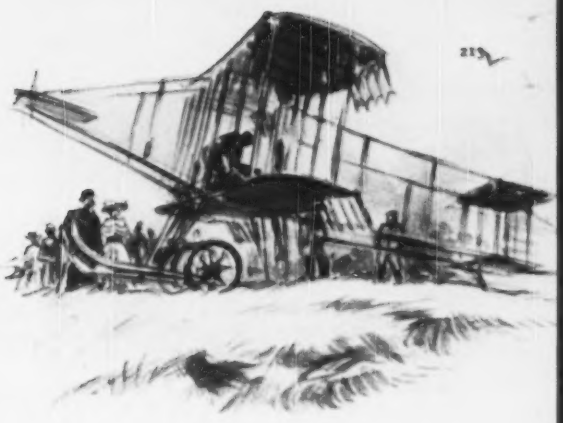
HERCULES 733
T.E.A. Solents completed airworthiness trials and all four aircraft were delivered to New Zealand.

HERCULES 634
Four Hercules 634 engines in B.E.A. and Airwork Ltd., Vikings, each ran for 1,000 hours between overhauls.



The de Havilland Aircraft, Engine and Propeller Companies extend warm congratulations to the Bristol Aeroplane Company upon the completion of forty years of successful service to British aviation, and they look forward to continued happy co-operation

DH
ENTERPRISE



BRISTOL *cavalcade*

A Retrospect of Aircraft, Engine, and Armament Development Over Forty Years

Sir George White, Bt., founder of the British and Colonial Aeroplane Co., Ltd. (b. 1854; d. 1916).

EVEN at the time of its inception, in 1910, the Bristol Aeroplane Co., Ltd., (originally styled the British and Colonial Aeroplane Co., Ltd.), was a firm with a difference. Unlike most of its contemporaries, it was founded with the specific object of designing and manufacturing aircraft *on a commercial scale*. Hear Sir George White, chairman of the Bristol Tramway and Carriage Co., addressing the annual meeting in the Grand Hotel on February 16th, 1910:—"I may tell you that for some time past my brother and I have been directing our attention to the subject of aviation . . . we have determined personally to take the risks and expense of the endeavour to develop the science. . . ."

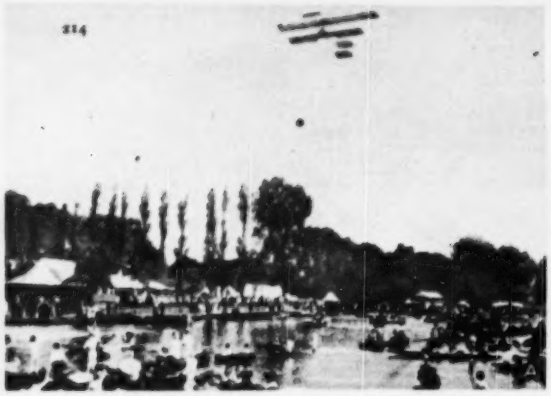
He added that several aircraft of the best design hitherto produced were already on order, with the intention of developing a British industry and of making Bristol its headquarters. Three days later the company was formed.

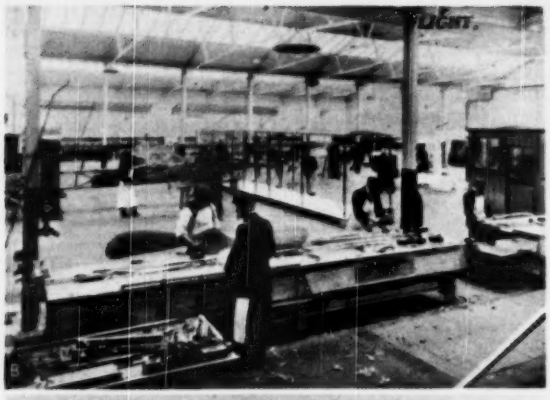
Testimony to the abundant fulfilment of Sir George's vision (though he himself did not live to see it—he died on November 22nd, 1916) is borne by the following pages. Herein are depicted in photographs, from the Bristol archives and the files of *Flight*, all types of Bristol aircraft and engines, together with a large number of variants. Many of these will be unfamiliar, or even, we suspect, quite unknown, except among those few Bristolians concerned with their development. To this pictorial and factual survey of Bristol products, rather than a general history of the organization, our space has been principally apportioned, but the main course of the company's development may be traced by way of preface.

In furtherance of Sir George White's declared intentions, land was acquired at Filton, the offices being contained in the delightful private residence which still graces the frontage of the vast works. A licence was negotiated for building French Zodiacs, but the first example proved unsatisfactory and was abandoned. Undaunted, Sir George engaged his own design staff. Flying schools were established at Larkhill, on Salisbury Plain, and, later, at Brooklands, and the first "Box Kite" (based on the Henry Farman design) appeared in June, 1910. Various versions were built, the military type being powered with a 70 h.p. Gnome engine in place of the 50 h.p. unit. (In either case, it is said, these early rotaries used nearly as much oil as petrol.) Piloted by Capt. Bertram Dickson, a Box Kite was the only machine to fly over the 1910 Army Manœuvres on Salisbury Plain. Onlookers included Sir George French, Lord Kitchener, Lord Roberts and Mr. Winston Churchill. A few days later the first wireless signals were transmitted from a Box Kite to the ground.

Within a year some thirty aircraft were built at Filton and six pilots had been trained on Bristol types. Early in 1911 the first government contract was received (from Russia!), and the British Government ordered four aircraft.

During 1912 the Military Trials were held on Salisbury Plain, and in addition to two Gordon England biplanes the British and Colonial Aeroplane Co. entered two monoplanes, designed by M. Coanda, a Rumanian. Piloted by Harry Busteed and Howard Pixton, these machines secured





BRISTOL CAVALCADE . . .

two third prizes. Following this period, however, development was somewhat arrested by wing failures, leading to the banning of monoplanes throughout the country, so that for two or three years the biplane was unrivalled in Great Britain; but Bristol monoplanes continued to be sold abroad, and even manufactured under licence.

A portentous development, on the Coanda military biplane displayed at the Paris Salon in December, 1913, was the provision for twelve small bombs in the belly of the fuselage. They could be released by a lever at prescribed intervals, and a sight was provided for the observer. For the Olympia Show in March, 1914, the firm prepared two biplanes, of which the little single-seater Scout, jointly designed by Harry Busteed and Frank Barnwell, was enthusiastically acclaimed.

Notwithstanding the excellent performance of the little biplane, the Bristol Company was working on the first of the wire-braced M.1 monoplane series, the ultimate development of which had a speed range of 50-130 m.p.h.; but Bristol's greatest contribution to the war was the famous two-seater Fighter biplane ("Brisfit" or "Biff"), of which some 3,500 were built at Bristol and elsewhere.

Aircraft which materialized between the wars were too numerous to be named here, but exceptions must be made of the internationally accepted Bulldog single-seater fighter, the record-breaking Type 138A high-altitude monoplane, and *Britain First*, precursor of the illustrious Blenheim. These, and numerous other types, bear testimony to the ability of Mr. L. G. Frise who resigned in ill-health during 1946, previously having been succeeded as chief designer by Mr. A. E. Russell. The Beaufighter holds an enviable place in the hearts of R.A.F. crews, and to-day the Brigand bomber furthers the Bristol tradition in the Service. Type 170—a freight and passenger transport of quite exceptional versatility—is earning its keep in many lands; helicopter progress is, to say the least, encouraging, and trials of the giant Brabazon I are well in hand.

The history of the Bristol Engine Division covers a shorter span. Briefly, this department grew out of the motor manufacturing firm of Brazil Straker and Co., which during the 1914-18 war manufactured aircraft engines and which, at the invitation of the Air Ministry, built a 14-cylinder, air-cooled radial unit in 1917. This was called the Mercury, and a specimen was tested in a Bristol Scout in 1919. The 450 h.p. nine-cylinder Jupiter was completed in 1918, and even at that time Mr. A. H. R. Fedden, the technical director of Brazil Straker (now reorganized and renamed the Cosmos Engineering Co.), had designs for a 1,000 h.p. 18-cylinder, two-row radial which was to have been named the Hercules. In 1920 the Cosmos Company went into liquidation and the entire rights of the firm, together with all designs, were acquired by the Bristol Aeroplane Co. Mr. Roy Fedden became chief engineer.

C

Peace—and Two Wars—in Pictures

A. Donald Graham Gilmour's Box Kite over Henley Regatta in July, 1911. For this escapade his Aviator's Certificate was suspended for one month.

B. The "works" in January, 1911, showing airscrew and aircraft production.

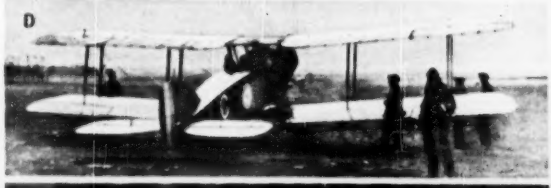
C. Bristol Scouts of the R.N.A.S. in Flanders during the spring of 1913.

D. Bristol Fighter F.2B of No. 22 Squadron on April 1st, 1918, about to make the first sortie of the newly constituted R.A.F.

E. King George V examining a Bristol Fighter on November 8th, 1917. Mr. Henry White Smith is in attendance.

F. Their Majesties King George VI and Queen Elizabeth, attended by Capt. Cyril Uwins, during their inspection in 1940.

D



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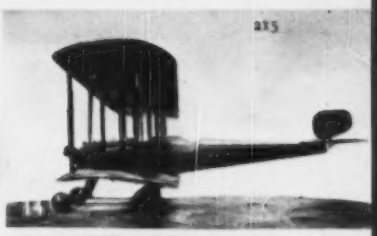
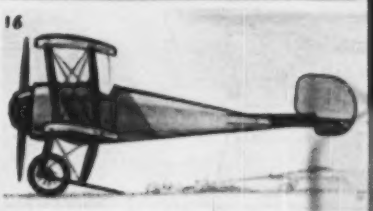
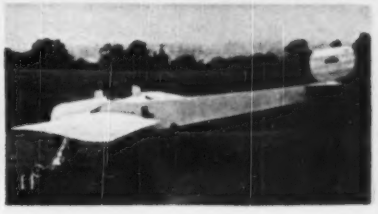
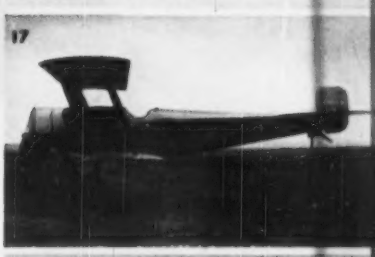


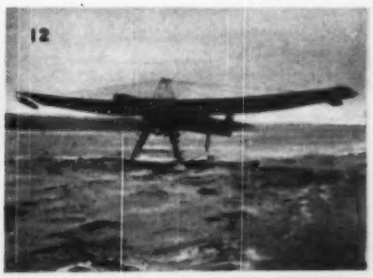


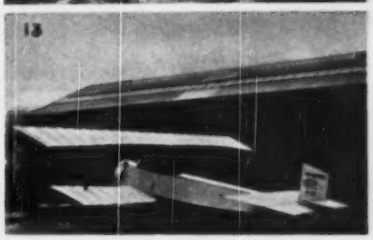


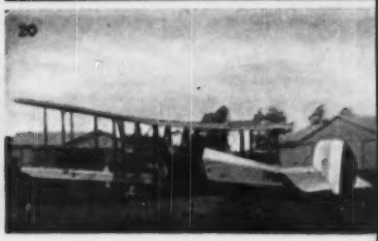


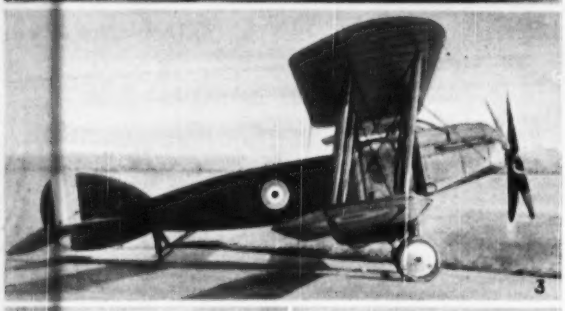
Bristol Aircraft From 1910

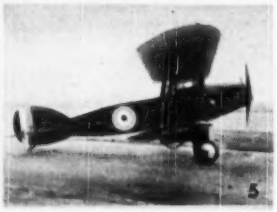
1. A typical Box Kite of 1910. The engine is a 50 h.p. Gnome rotary.
2. The E.N.V. School Biplane, with extended wing span. 1910.
3. Challenger-Dickson Type T of 1911, with a contemporary Rolls-Royce.
4. Prier single-seater monoplane (1911) with its designer, M. Pierre Prier.
5. The Prier two-seater of 1911, as displayed in the Paris Salon.
6. Gordon England G.E.1, 1912. 7. G.E.2, 1912. 8. G.E.3, 1912.
9. Prier-Dickson two-seater of 1912. 10. Prier School Machine (3-cylinder Anzani engine) of 1912.
11. Coanda monoplane built for the British Military Trials, 1912.
12. Burney X.2 "hydroped" seaplane, with hydrofoil vanes, under tow in 1912. The machine became airborne, but stalled and crashed.
13. Grandseigne racing biplane of 1913, with 50 h.p. Gnome rotary.
14. Coanda B.R.7 biplane (1913) with characteristic Coanda undercarriage.
15. Coanda two-seater central-float seaplane of 1913—a clean design.
16. Sketch of the Coanda single-seater armoured biplane built in 1914.
17. Bristol Baby biplane (Scout A) of 1914. 80 h.p. Gnome engine.
18. Coanda T.B.8 late-series biplane (with ailerons) of 1914-16.
19. The Scout C (80 h.p. Gnome) of 1915. (Compare with No. 17.)
20. T.T.A. two-seater fighting biplane. 1916. 120 h.p. Beardmore engines.

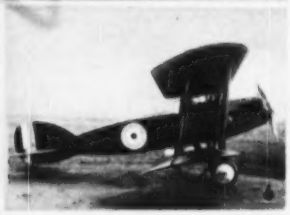


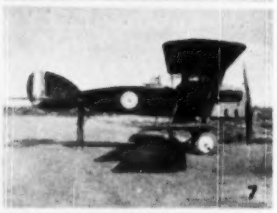


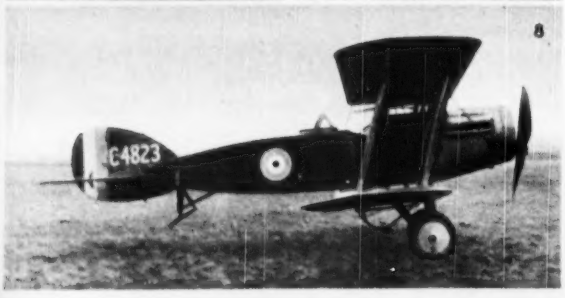












BRISTOL CAVALCADE . . .

1. Type 8 (S.2A) Two-seater Scout. 1916. Wide-fuselage development of earlier Scouts with side-by-side seats for pilot and "air gunner," who would have been armed with a rifle. Two examples built. Clerget engine. Span 28ft 2in. Max. speed 95 m.p.h.

2. Type 5 (Scout D) Single-seater Scout. 1916. Ultimate development of Type 1, having Clerget engine (earlier versions had le Rhone or Gnome) and wing area of 200 sq ft.

3. Type 12 (F.2A) Fighter. 1916. Depicted is the first version of the first prototype of the historic Bristol Fighter ("Brisfit"), fitted with 190 h.p. Rolls-Royce engine and side radiators. Designed by Capt. Frank Barnwell as a high-performance two-seater fighter in which the gunner could guard against surprise attacks.

4. Type 12 (F.2A) Fighter (Second Version). 1916. This variant had a nose radiator for the 190 h.p. Rolls-Royce Falcon I engine.

5. Type 12 (F.2A) Fighter (Second Prototype). 1916. Generally similar to its forerunner but fitted with 180 h.p. Hispano Suiza engine.

6. Type 16 (F.2B) Fighter (Second Prototype, Modified). 1917. The fuselage of this development was modified to the later F.2B standard.

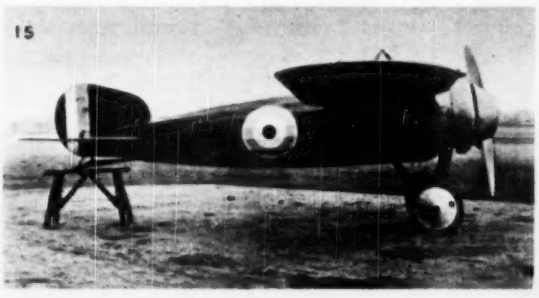
7. Type 15 (F.2B) Fighter (Sunbeam Arab). 1918. A late wartime development of the F.2B fighter, intended for Corps reconnaissance and powered with 220 h.p. Sunbeam Arab engine.

8. Type 14 (F.2B) Fighter. 1917. Typical of the standard F.2B with 250 h.p. Rolls-Royce Falcon III engine. Appeared on the Western Front early in 1917 and flew the first sortie made by the newly constituted Royal Air Force at dawn on April 1st, 1918. Some 3,500 were built and the type remained in service until 1928. Armament, one synchronized Vickers gun and one or two Lewis guns on Scarff ring. Twelve 20-lb Cooper bombs. Span, 39ft 3in. Gross weight, 2,800 lb. Max. speed, 125 m.p.h. Climb to 10,000ft, 11.5 min. Other variants of F.2B were Type 16 (200 h.p. Hispano Suiza) and Types 17, 17a and 17b (300 h.p. Hispano Suiza).

9. Type 14 (F.2B) (Communications). 1919. A dual-control modification of the F.2B for communications duties.

10. Type 27 (F.2B) (Coupé (2)). 1919. The first attempt at a civil version of the F.2B Fighter. Rolls-Royce Falcon engine.

11. Type 28 (Puma Coupé (3)). 1919. A three-seater



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coupé development of the F.2B with Siddeley Puma engine and rearward-hinging roof for passenger compartment.

12. Puma Tourer. 1920. A two-seater Puma-engined civil development of the F.2B.

13. "The Honeymoon Express." 1920. Puma-engined three-seater F.2B development.

14. Type 48 (Puma Seaplane (3)). 1920. A three-seater tourer floatplane development with Puma engine.

15. Type 20 (M.1C) Monoplane. 1917. Developed from M.1A (Type 10) and M.1B (Type 11) and powered with the 110 h.p. Le Rhone engine, the M.1C—outcome of Capt. Barnwell's conviction that Bristols could build a fast, strong monoplane—saw service in the Middle East. Armament, one synchronized Vickers gun. Span, 30ft 8in. Gross weight, 1,300 lb. Max. speed, 130 m.p.h. Climb to 10,000ft, 9 min.

16. Type 13 (M.R.1). 1917. The first all-metal aircraft to be flown in Great Britain, the M.R.1 was intended for reconnaissance and was powered with 150 h.p. Hispano Suiza engine. The wire-braced steel-tube fuselage had a covering of aluminium skin.

17. Badger "X." 1919. (Siddeley Puma.) A cheaply produced sporting biplane using components of the Type 23 Badger. Popularly called "Barnwell's Weekender." Reputed to have been designed by him in a single week-end.

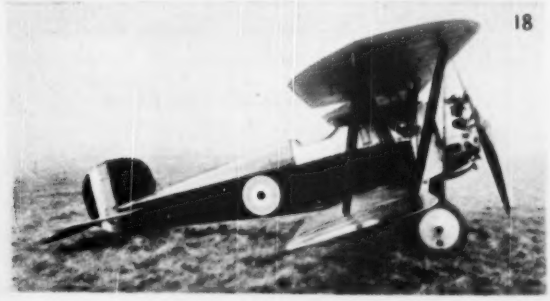
18. Type 21A (Scout F). 1918. Developed from Type 21, with Sunbeam Arab, this was the first Bristol type tested by Capt. Cyril Uwins. It was powered by the Cosmos Mercury radial engine and achieved over 140 m.p.h.

19. Type 24 (Braemar I). 1918. Designed for the bombing of Berlin, this type had four Siddeley Puma engines and could carry six 250-lb bombs. Span, 81ft 8in. Gross weight, 16,500lb. Braemar II (Type 25) had Liberty engines and weighed 18,000 lb.

20. Type 26 (Pullman) 14-seater Transport. 1920. This development of the Braemar bomber had a fuselage of larger cross-section and was furnished to an exceptional standard of luxury. The fuel tanks for the four Liberty engines were between the two cabins. Span, 81ft 8in. Gross weight, 17,750 lb. Max. speed, 135 m.p.h.

21. Type 30 (Babe Mk.1). 1919. A single-seater sporting biplane first fitted with 35 h.p. Viale engine. The Mk. III version had the 60 h.p. Le Rhone. Span, 19ft 8in.

22. Type 23 (Badger). 1919. Illustrated is the first Badger prototype with A.B.C. Dragonfly radial engine. This two-seater fighter had two synchronized Vickers guns and a free Lewis gun. Span, 36ft 9in. Speed, 135 m.p.h.



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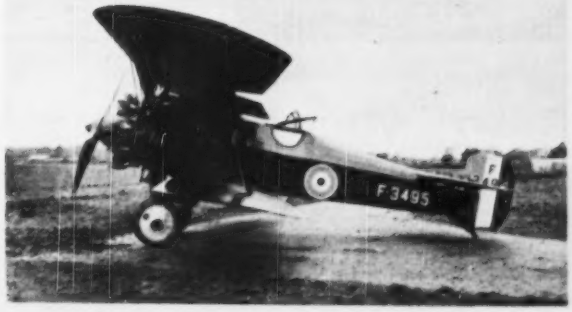

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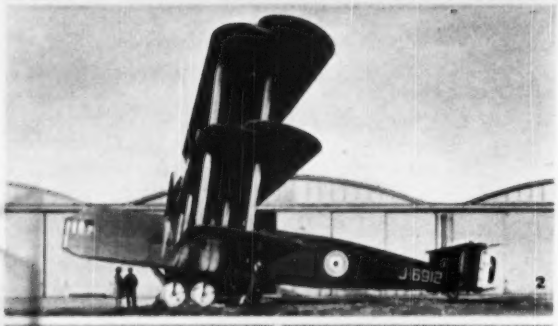

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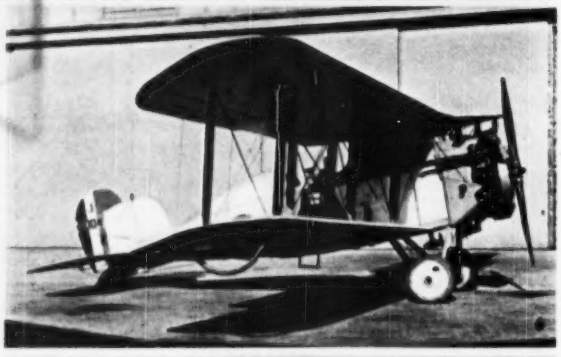

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BRISTOL CAVALCADE . . .

1. Type 32 (Bullet) (First Modification). 1920. The racing machine depicted was fitted with the first Bristol-built Jupiter engine and differed from the first version in having a large spinner. In its final form it had wings of shorter span and achieved a top speed of about 170 m.p.h. Flown into second place in the 1920 Aerial Derby by Capt. Uwins.

2. Type 37 (Tramp). 1921. Officially classed as a "spares carrier," this triplane was developed from the Pullman and Braemar and had four Siddeley Puma engines. With a view to decreasing drag, these were housed in a central engine room and drove two airscrews through gears and shafting. Due to mechanical difficulties, the Tramp was never flown.

3. Type 76 (Jupiter Fighter) (Modified F.2B). 1923. The fitting of a Jupiter engine and the adoption of an oleo undercarriage distinguished this late development of the "Brisfit" from its forebears. A notable improvement in performance was achieved, the amixmum speed being 135 m.p.h.

4. Type 89 (Jupiter School Machine). 1925. This trainer counterpart of the Jupiter Fighter had plywood fuselage covering for increased strength, Frise ailerons, and, as will be seen, increased fin and rudder area. It gave excellent service with the Bristol Flying School.

5. Type 36 (Seely Puma). 1920. Designed for the Air Ministry Competitions, which opened at Martlesham Heath late in 1920, this three-bay biplane reproduced certain features of the Bristol Fighter but was powered with a 240 h.p. Siddeley Puma, and had a deepened fuselage to allow the single passenger to be totally enclosed. The pilot remained exposed. A landing skid was fitted in addition to the main wheels. Span, 47ft 11in. Gross weight, 3,000 lb. Max. speed, 128 m.p.h.

6. Type 83 (Seely Supercharger). 1923. Sometimes known as the Seely II, this experimental development was powered with a Jupiter engine having an exhaust-driven supercharger. The undercarriage skid was deleted.

7. Type 62 (Ten-Seater) (Lion). 1921. First flown in January, 1924, the Ten-Seater was designed to carry a greater load than hitherto on the 450 h.p. of a Napier Lion engine. Features included a four-wheel main undercarriage and underslung petrol tanks. Span, 54ft. Gross weight, 6,800 lb.

8. Type 75 (Jupiter Ten-Seater). 1923. A cleaned-up and re-engined development of the original Ten-Seater. Span, 57ft 6in. Gross weight, 6,750 lb. Max. speed, 112 m.p.h.

9. Type 75A (Express Freighter). 1924. This machine bore the same relationship to the Jupiter Ten-Seater as does

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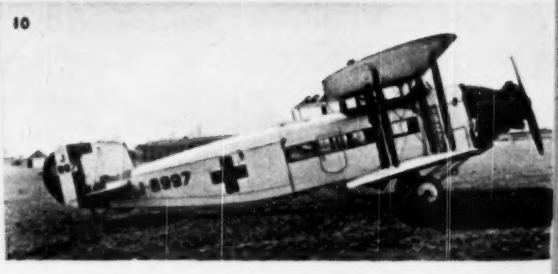

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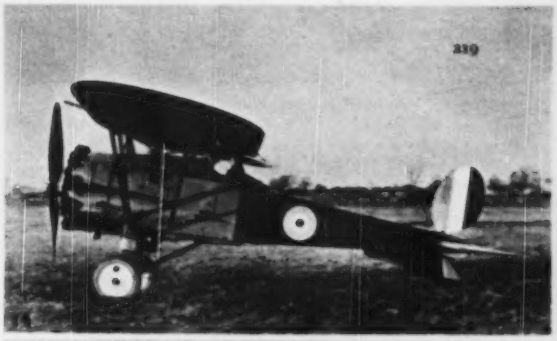


the present-day Type 170 Freighter to the passenger-carrying Wayfarer. Nearly 2,000 lb of cargo could be carried.

10. Type 79 (Brandon). 1925. An ambulance development of the Ten-Seater to meet R.A.F. requirements, the Brandon is depicted in its later form, with lengthened nose.

11. Type 77 (M.1D) (Lucifer Monoplane). 1922. This racing development of the earlier monoplane scouts was powered with 100 h.p. Lucifer three-cylinder radial engine, and generally cleaned up. Piloted by Capt. Uwins, it won the Croydon Whitsun Handicap in 1922, and, in the hands of "Larry" Carter, was victorious in the Aerial Derby Handicap. The maximum speed was about 130 m.p.h.

12. Type 72 (Jupiter Racer). 1923. This remarkable machine, designed by Mr. W. T. Reid, had a retractable undercarriage and a streamlined fuselage of large overall cross-section behind the Jupiter IV engine which was housed in a ducted cowling. Wing flexing caused Capt. Uwins some embarrassment on the first test flight, and in view of the high landing speed the type was not "everybody's aircraft." The top speed was estimated to be well over 200 m.p.h.

13. Type 73 (L.3S) (Lucifer Taxiplane). 1922. This attractive three-seater biplane, built for the Lucifer engine, seated its two passengers side by side in an open cockpit behind the pilot. As the photograph shows, passengers gained access by a door. The type was developed into the Type 83 School Machine. Span, 31ft. Gross weight, 2,000 lb.

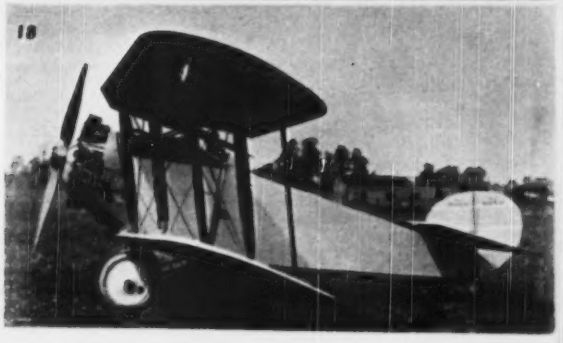
14. Type 52 (Bullfinch) (M.F.A.). 1923. The Bullfinch Type 52 was a single-seat fighter laid out as a parasol monoplane and powered with a Jupiter engine. The armament was two Vickers guns, the span, 38ft 5in, and the speed, 135 m.p.h.

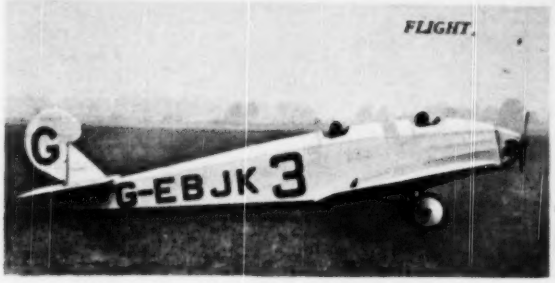
15. Type 53 (Bullfinch) (M.F.B.). 1924. Comparison of this and the preceding photograph will show that the Type 53 was a two-seater development of the Type 52, having a second wing attached beneath the inserted rear-cockpit section.

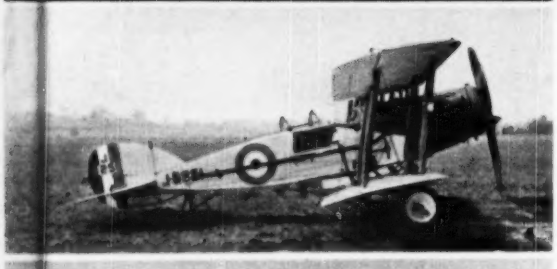
16. Type 83 (L.2S) (Lucifer School Machine). 1924. A training adaptation of the Lucifer Taxiplane, this two-seater was adopted as a primary trainer by the Bristol Flying School, where it remained in service until superseded by the Tiger Moth. Having a fuselage of smaller cross-section, it was somewhat faster than the taxi machine.

17. Type 91 (Brownie Mk. 1). 1924. Built for the Air Ministry Light Aeroplane Trials at Lympe, and powered by a 33 h.p. Cherub, the Mk. 1 Brownie was of all-metal construction with fabric covering. Span, 36ft 7in.

18. Type 84 (Bloodhound). 1925. The machine illustrated is the first prototype of the Bloodhound two-seater fighter (Jupiter), with metal fuselage and wooden wings.







BRISTOL CAVALCADE . . .

1. Type 90 (Berkeley Mk. 1). 1925. The particular Berkeley shown in the photograph is the first prototype, with wooden wings. Designed round the 650 h.p. Rolls-Royce Condor engine, the Berkeley was built to meet an Air Ministry Specification for a large single-engined bomber of long range. Of all metal (steel and duralumin) construction, the Berkeley had a capacious fuselage and measured 57ft 11in in span. A typical bomb load was 500 lb, and the armament was one fixed Vickers gun and one free Lewis gun.

2. Type 84 (Bloodhound). (Metal Wings.) 1925. This photograph shows the metal-winged Bloodhound, with re-designed tail, used for a Bristol Jupiter endurance test lasting for 225 hr 54 min, in which a distance of 25,074 miles was covered without replacement of any engine parts.

3. F.2B Fighter (For Cranwell). 1925. Illustrated is a late "Brisfit" development, with dual control, supplied for the use of the Royal Air Force College at Cranwell.

4. F.2B Fighter Mk. III. 1925. This was the standard R.A.F. Army Co-operation machine, and was equipped with a message pick-up hook.

Type 92 (Laboratory Machine). Neither the Bristol archives, nor the files of *Flight*, though forming some of the most complete records of their kind in the country, contain a photograph of this research aircraft. It was a two-seater tractor biplane powered with a Jupiter engine.

5. Type 93 (Boarhound). 1926. Designed to meet Air Ministry requirements for a general-purpose aircraft, to replace the Bristol Fighter and D.H.9A, the Boarhound was of all-metal construction. It was later developed into the Beaver.

6. Type 93A (Beaver). 1927. Almost identical with the Boarhound, the Beaver was likewise fitted with a Jupiter VI engine but had a redesigned tail unit. A batch was supplied to the Mexican Army Air Force. Span, 44ft 9in. Gross weight, 4,460 lb. Max. speed, 142 m.p.h.

7. Brownie 1B. 1926. The dainty little Brownie light monoplane is seen in its Mk. 1B form, as modified for the 1926 Light Aeroplane Competitions.

8. Type 95 (Bagshot). 1927. Originally called the Bludgeon, this courageously designed twin-Jupiter fighter, to Spec. 4/24, was built to take two 37 mm Coventry Ordnance Works shell-firing guns. The type was not successful due to the flexibility of its wing which, on the first flight, brought about a reversal of aileron action. The fuselage was unusual in being of inverted triangular section. Span, 70ft. Gross weight, 8,200 lb.

9. Type 99 (Badminton I). 1926. Designed—solely for sporting purposes—round the Jupiter engine, the Badminton I had a span of only 24ft 11in and, as will be seen, was characterized by a "helmeted" engine cowling. It was rebuilt as the Badminton II (see below).

10. Type 99A (Badminton II). 1927. Tapered wings, broader in span than those of the Badminton I, were fitted to this machine; single interplane struts and revised bracing were also introduced. It was in the Badminton II that Capt. F. L. Barnard was killed while practising for the 1927 King's Cup Race.

11. Type 101. 1927. Of clean, attractive lines, this two-seater fighter was shown at the Copenhagen Aeronautical Exhibition in 1927. Later the rear cockpit was faired over and the airframe generally cleaned up, and the machine was used for engine development flying. In the next column a photograph shows the aircraft as flown in the 1928 King's Cup Race.

12. Type 83C. 1927. This attractive-looking little aircraft was a Lucifer trainer cleaned-up for racing.

13. Type 83E. 1928. This further development of the Type 83 was powered with a Bristol Titan five-cylinder engine.

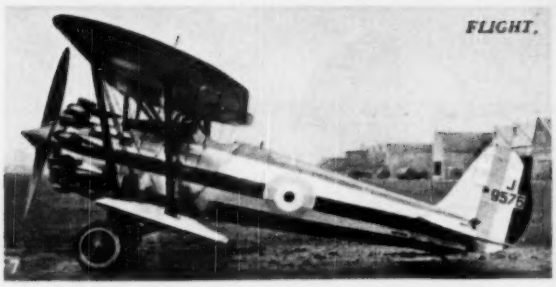
14. Type 101 (Modified). 1928. The Type 101 is seen in racing trim, with provision for a passenger.

15. Type 109 (Long-range Biplane). 1928. Intended to fly at least 5,000 miles non-stop, the Type 109 carried nearly 900 gallons of fuel and was powered with a Jupiter VIII geared engine. For various reasons no attack was made on the world's long-distance record and eventually the machine was used for engine development flying.

16. Type 107 (Bullpup). 1928. The Bullpup, designed to Specification F.20/27, is here seen in its original form. This high-altitude interceptor was virtually a scaled-down version of the Bulldog, and is shown with a Jupiter VIA engine, though the Mercury was later installed. The interplane struts and empennage should be compared with those of later variants. Span, 30ft.

17. Type 107 (Bullpup) (Mercury IIA). 1928. This view of the Bullpup with the Mercury IIA engine affords an interesting comparison with that of the original version above.

18. Type 110A Commercial Biplane. 1929. The Type 110 Commercial Biplane was designed round the 220 h.p. five-cylinder Titan engine, but before this type materialized the 315 h.p. Neptune had become available, and the 110A was designed to profit from the extra power. The long-chord cowling, as shown, was a departure of special interest. Span, 44ft 6in. Gross weight, 4,250 lb. Max. speed, 125 m.p.h.



BRISTOL CAVALCADE . . .

1. Type 118. 1931. A versatile general-purpose aircraft of compact design, the Type 118 was of all-metal construction and was powered with a Jupiter XF engine. It was developed into the Type 120, described below.

2. Type 120. 1932. This type was the first Bristol machine to have an enclosed gun turret. Colloquially known as the "parrot cage" this was manually operated, but was the forerunner of a series of outstanding power-driven turrets developed for later types of aircraft by the armament division of the Bristol Company. A single Lewis gun was fitted and the pilot had a synchronized Vickers gun. Provision was made for a stretcher case under the fuselage decking aft of the turret. A bomb load of up to 500 lb could be slung externally. The Type 120 was not produced in quantity but gave valuable service as a test bed for the Mercury engine.

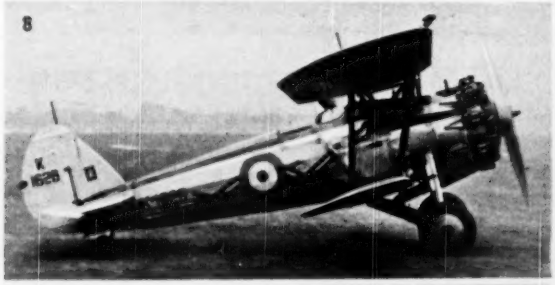
3. Type 105 (Bulldog I). 1927. Probably the most famous of all Bristol single-seat fighters, the Bulldog, the first prototype of which is depicted, was first flown in May, 1927. The engine was a supercharged Jupiter VII, and steel construction was used for fuselage and wings. The traditional armament of two synchronized Vickers guns was retained. Considering that it was a biplane, the Bulldog afforded an exceptionally wide field of view; it was robust, had pleasant flying characteristics, and a speed of over 170 m.p.h. at 10,000ft. Later variants were adopted not only by the R.A.F. but by seven other air forces. Span, 33ft 10in.

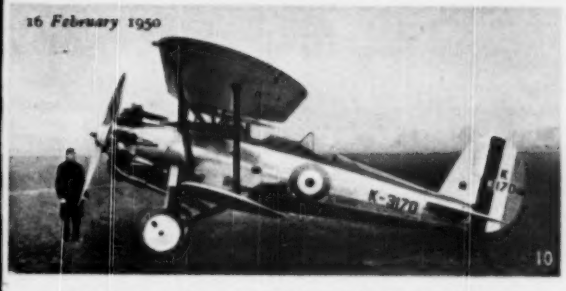
4. Bulldog I (Second Prototype). 1927. Little, if any, information has previously been published on this Bulldog development which, as will be seen, had wings of greatly increased area, with a view to securing a higher rate of climb and ceiling.

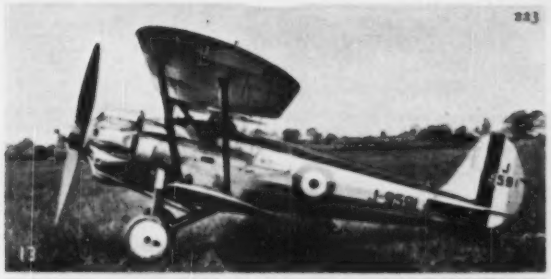
5. Bulldog II Prototype (Lengthened Fuselage). 1928. The specimen shown was the first Bulldog to have the lengthened fuselage, subsequently standardized, and will be seen to differ considerably from the first prototype.

6. Bulldog II (Production Type). 1928. Illustrated is the first production type Bulldog II, with Jupiter VII engine and equipped to full R.A.F. standards.

7. Bulldog II (Early Service Type). 1929. Bulldog J9576, the subject of this photograph, was one of the first batch delivered to the R.A.F. and bears the markings of No. 3 Squadron, Upavon. R.A.F. Bulldogs from K1079 onwards







had a new-type, built-up, but rivetless, rear fuselage. The Jupiter VIIF engine was later substituted for the Jupiter VII.

8. Bulldog IIA. 1931. The markings of No. 17 Squadron will be recognized in this picture of a Bulldog IIA, taken in 1936. The Bulldog IIA differed from its forerunners in having a wider undercarriage, "fatter" tyres, a modified oil system, structural stiffening, and a redesigned fin.

9. Bulldog (Mercury III). 1930. It will be seen that the experimental Mercury III-engined Bulldog had a long cowling over the reduction gearing, and four-blade fixed-pitch airscrew.

10. Type 124 (Bulldog Two-Seater). 1931. To Specification T.12/32, the Bristol Company developed this useful fighter trainer variant of the Bulldog. No armament was fitted, and the rear fuselage was redesigned with a second cockpit.

11. Bulldog IIA (Danish). 1931. The Bulldog shown was one of a batch for Denmark. As will be seen, the guns (Madsens) were mounted lower in the fuselage than formerly.

12. Bulldog IIIA. 1931. The wings of this Bulldog development were thick enough to accommodate the fuel tanks and to allow a reduction of 7in. in the chord on the bottom wing. Other departures from former Bulldog practice included the fitting of a Mercury IVS2 geared and supercharged engine with Townend ring cowling; a special type of oil tank, incorporating an oil cooler (an external cooler was fitted in addition); and single lift wires. "Spats" were fitted over the Dunlop disc wheels, which had Bendix brakes. The maximum speed was over 200 m.p.h.

13. Bulldog III. 1930. This machine was characterized by a little-known installation of a Mercury IVA in a "helmeted" cowling.

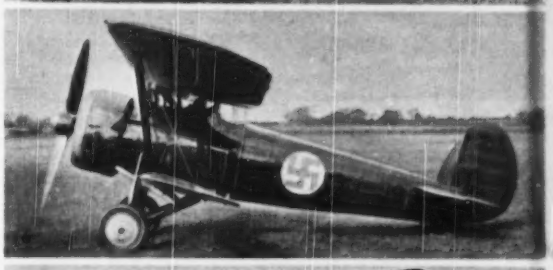
14. Bulldog IIA (Aquila). 1933. Valuable experience with the Aquila III two-row, sleeve-valve, radial engine was gained with this adapted Bulldog.

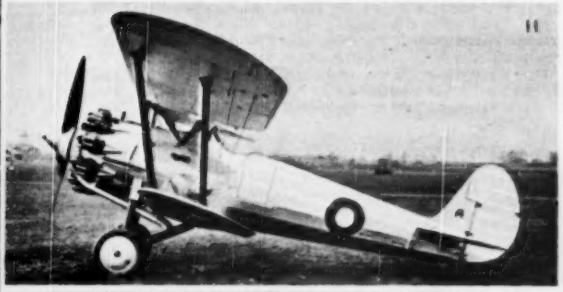
15. Bulldog IVA. 1933. The Mk. IVA was the last of the basic Bulldog types. The example shown had a Mercury VIS2.

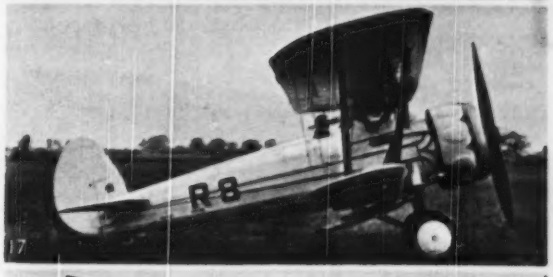
16. Bulldog IVA (Finland). 1934. This late Bulldog IV may be compared with the specimen shown above. It will be noted that a leading-edge exhaust collector is incorporated in the engine cowling.

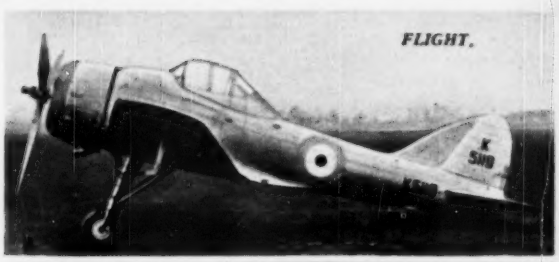
17. Bulldog IVA (Perseus). 1934. Powered with the Perseus 1A single-row, sleeve-valve engine, and with silenced exhausts, this Bulldog flew in the 1934 S.B.A.C. Display.

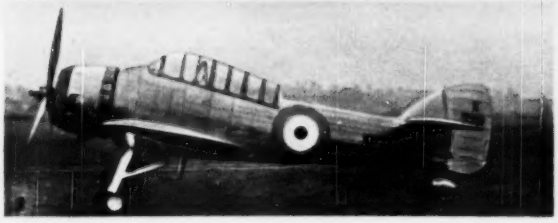
18. Bullpup (Aquila). 1934. Another Bristol type to perform at the 1934 S.B.A.C. Display was this version of the Bullpup, with Aquilla III sleeve-valve engine.

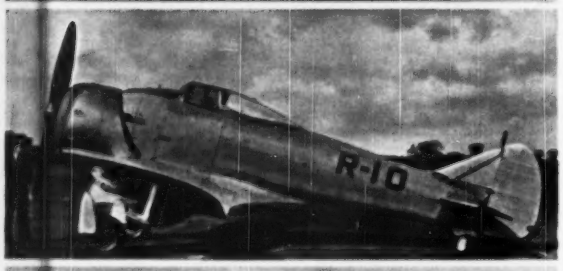


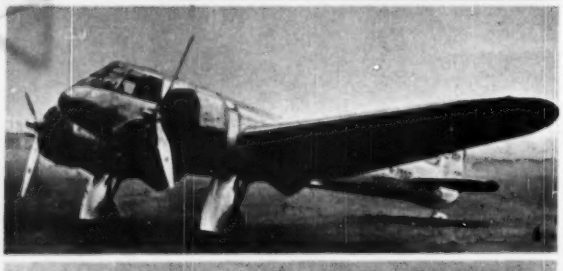


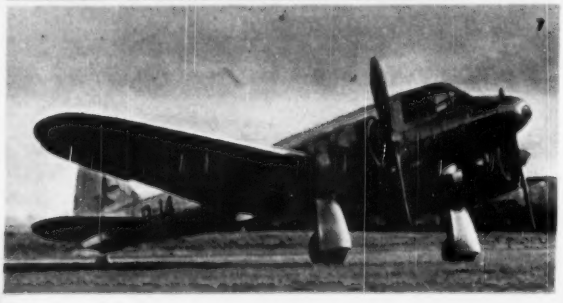












BRISTOL CAVALCADE . . .

1. Type 123. 1934. A fighter to Spec. F.7/30, armed with four .303in Vickers guns and powered with a Rolls-Royce Goshawk engine.

2. Type 130 (Bombay) (Prototype). 1935. An all-metal bomber transport, with monocoque fuselage, the Bombay measured 95ft 9in in span and had a gross weight of 20,000lb. The type gave excellent war service, especially in France, the Middle East and Greece.

3. Type 130 (Bombay) (Production). 1939. The machine illustrated is the production-type Bombay, as built by Short and Harland at Belfast.

4. Type 133, 1934. A private venture, to spec. F.7/30, this four-gun monoplane was fast (maximum speed 260 m.p.h.) and is said to have had excellent flying qualities.

5. Type 138A. 1936. Of all-wooden construction, this large monoplane (span, 66ft), piloted by S/L. F. R. D. Swain, achieved a record height of 49,967ft during September, 1936. In modified form it again broke the altitude record, held at the time by Italy, with a height of 53,937ft. The pilot was F/L. M. J. Adam.

6. Type 142 (Britain First). 1935. Built to the order of Lord Rothermere, *Britain First* astounded the flying world by achieving a speed of over 300 m.p.h. It was the forerunner of the Blenheim bomber and had two Mercury IV engines.

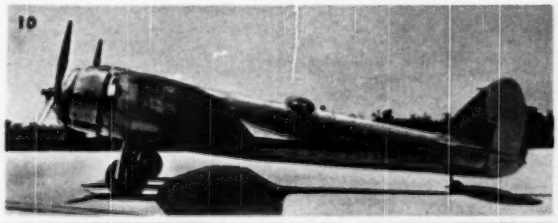
7. Type 143. 1935. A ten-seat civil monoplane, with Aquila engines. Span 56ft. 6in. Gross weight 8,700lb.

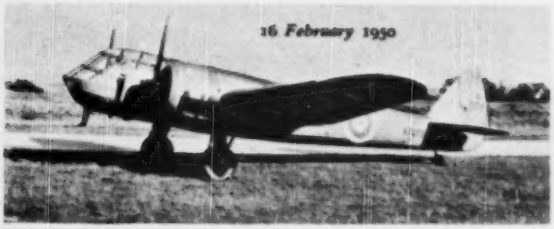
8. Type 146. 1937. A Perseus-engined fighter capable of nearly 290 m.p.h. and having a gross weight of 4,600lb. To Spec. F.5/34.

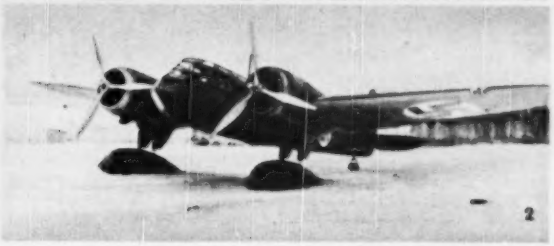
9. Type 148. 1937. Built, to Spec. A.39/34, for army co-operation duties, the Type 148 had a speed of nearly 260 m.p.h. and weighed 5,250lb. Originally fitted with a Mercury IX, it was eventually used for Taurus development flying.

10. Type 142M (Blenheim). 1936. The aircraft shown is the first prototype of the Blenheim I bomber. Span, 56ft. Speed 285 m.p.h. at 15,000ft. Bomb load 1,000lb.

11. Blenheim I (Production). 1937. Seen here is a typical R.A.F. production-type Blenheim I. Both bomber and fighter versions were used extensively in the early months of the war.







BRISTOL CAVALCADE . . .

1. **Type 149 (Blenheim III). 1939.** An experimental Blenheim variant with a redesigned nose.

2. **Blenheim I (Finnish). 1938.** This photograph shows the neatly designed and streamlined ski undercarriage developed for the Blenheim Is supplied to Finland.

3. **Type 149 (Blenheim IV). 1939.** This variant superseded the Mk. 1 in R.A.F. service. It had a lengthened nose with facilities for navigation, and tankage for a range of up to 1,900 miles. Late aircraft had a twin-gun dorsal turret in place of the earlier single-gun installation; a rearward-firing defensive gun was also fitted under the nose.

4. **Blenheim IV (Fighter). 1940.** The fitting of four 0.303in Browning guns beneath the fuselage of the Blenheim IV enabled the type to be employed as a long-range fighter.

5. **Type 149 (Bolingbroke IVW). 1941.** The Bolingbroke was very similar to the Blenheim IV but was adapted for construction and operation in Canada. The version shown was fitted with 750 h.p. Pratt & Whitney Twin Wasp Juniors.

6. **Bolingbroke IVC. 1941.** This variant was powered with single-row Wright Cyclone engines.

7. **Bolingbroke III (Seaplane). 1940.** A neat twin-float installation is seen on this Canadian Bolingbroke variant. Provision was also made for skis.

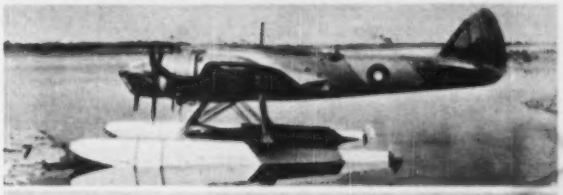
8. **Type 160 (Bisley, or Blenheim V). 1940.** Two versions of the Type 160—an armoured two-seater ground-attack aircraft and a three-seat high-altitude bomber—were built. Mercury XXX engines were fitted.

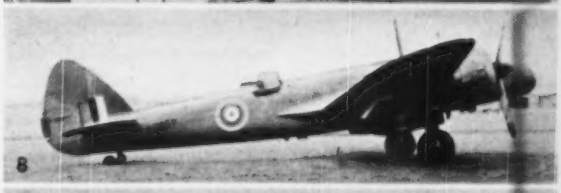
9. **Type 152 (Beaufort I) (Prototype). 1938.** Designed, to Spec. G.10/36, as a general reconnaissance and torpedo/bomber machine, the Beaufort was powered with two 1,065 h.p. Taurus 14-cylinder, sleeve-valve, radial engines. The original version is seen. Span, 58ft; length, 44ft 7in; gross weight, 21,230lb. Max. speed, 260 m.p.h.

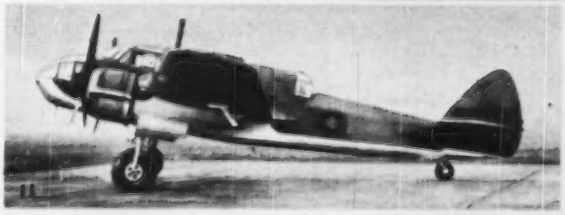
10. **Beaufort I (Modified). 1938.** The engine installation and undercarriage may be compared with the above.

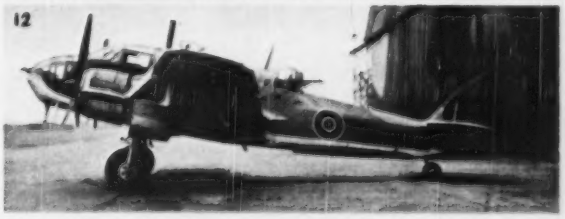
11. **Beaufort I. 1940.** An early-production Beaufort is depicted. Later machines had a rearward-firing gun in a blister beneath the nose, but the final version is seen below.

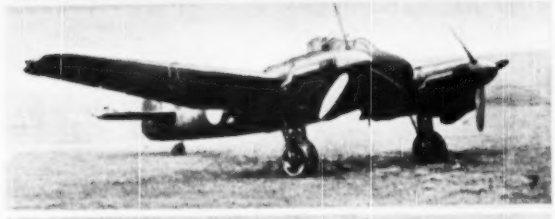
12. **Beaufort I. 1943.** This late-production Beaufort I had a Blenheim-type turret, gimbal nose guns and A.S.V. radar.

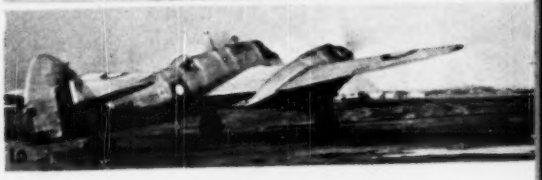












BRISTOL CAVALCADE . . .

1. **Beaufort VIII (Australian-built). 1944.** The aircraft depicted is the 700th Beaufort built in Australia (Pratt & Whitney Twin Wasp engines).

2. **Beaufort Transport. 1944.** An Australian adaptation, to take five passengers and with 30 cu ft of cargo space. Used by the Duke of Gloucester.

3. **Type 156 (Beaufighter I). 1939.** Using the wings, tail unit and undercarriage of the Beaufort, the Beaufighter was developed initially as a long-range fighter, but eventually saw service as a night fighter, torpedo bomber and attack aircraft. The first prototype of this now historic Bristol product is seen.

4. **Beaufighter I (Modified). 1940.** An early Beaufighter with modified engine cowlings and undercarriage doors.

5. **Beaufighter IIF. 1941.** The Mk. II Beaufighter night fighter series had Rolls-Royce Merlin engines. This particular example was a prototype, characterized by a long dorsal fin.

6. **Beaufighter (Twin-fin). 1941.** Experimental twin-fin variant of the Hercules-engined Beaufighter.

7. **Beaufighter V (Turret). 1941.** Two experimental specimens of this variant, with four-gun turret, were built.

8. **Beaufighter VIF. 1942.** Typical of the widely used Mk. VI Beaufighter, this specimen has provision for R.P.s and is radar-equipped.

9. **Beaufighter T.F.X. 1943.** Developed primarily for anti-shipping work, this mark had bellows-type dive brakes, and is seen carrying a torpedo. Span, 57ft 10in; gross weight, 25,000lb; max. speed, 330 m.p.h. at 14,000ft.

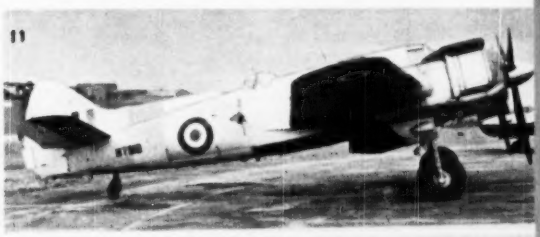
10. **Beaufighter (Cyclone). 1943.** An Australian-built machine with lengthened nacelles and Cyclone 14 engines.

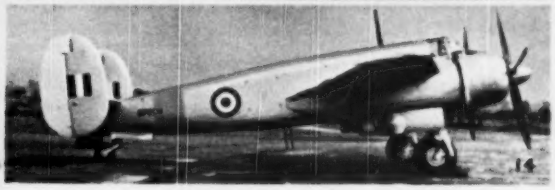
11. **Beaufighter T.T.X. 1947.** This is a target-towing version, provided with a winch and other special equipment.

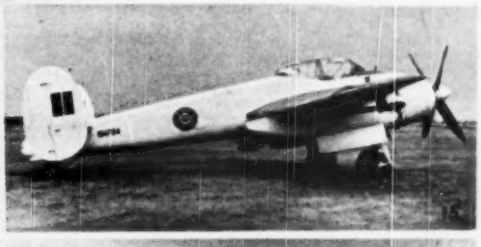
12. **Type 163 (Buckingham I). 1943.** A heavily armed bomber (two Centaurus), the Buckingham could carry a bomb load of 4,000lb. The first prototype is shown. Span, 71ft 10in; gross weight, 37,000lb; max. speed, 330 m.p.h.

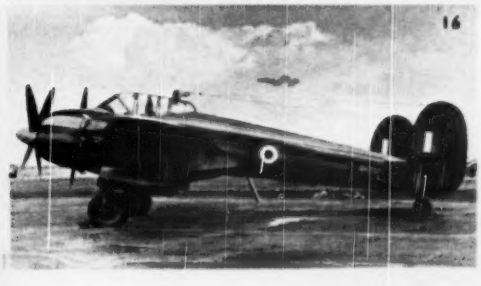
13. **Buckingham I. 1943.** In this view of a later Buckingham, the ventral gun position and nose guns can be seen.

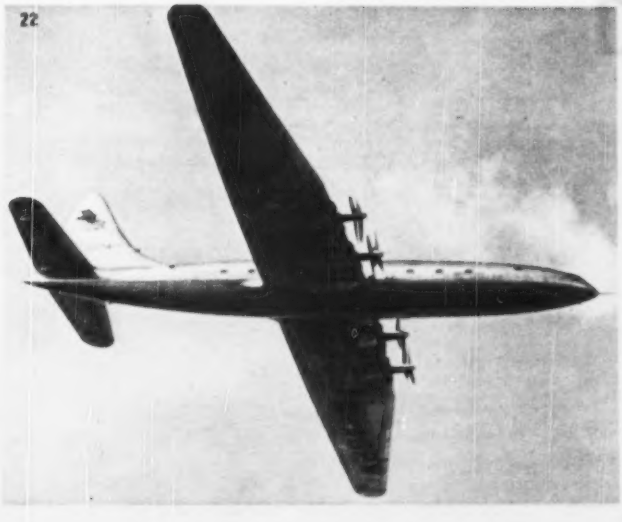
14. **Type 166 (Buckmaster I). 1946.** The Buckmaster, or











Buckingham Trainer, as it was originally known, is giving valuable service in the R.A.F.

15. Type 164 (Brigand T.F.1). 1944. Originally intended for use in the Pacific theatre, the Brigand (two Centaurus) is shown in torpedo/fighter guise, carrying a torpedo and rocket projectiles, in addition to its built-in armament of four 20mm guns and a free 0.5in gun. Span, 72ft 4in; gross weight, 38,200lb; max. speed, 345 m.p.h. at 14,000ft.

16. Brigand B.1. 1947. A bomber version adapted from the T.F.1 and now employed by the R.A.F. overseas.

17. Type 170 (Freighter/Wayfarer). 1945. Seven months after the war's end Capt. Uwins tested the first Type 170 Freighter, an exceptionally versatile and capacious twin-engined machine with a span of 98ft and a gross weight of 36,500lb. The passenger-carrying version was christened Wayfarer. The aircraft depicted is the first Freighter, with short-span wings.

18. New Type 170. 1948. The revised engine installation and long-span wings which characterized the New Type 170 (40,000lb gross weight) are both visible. A military version also exists.

19. Type 171 Mk.1. 1947. The Mk.1 version of the Type 171 helicopter, designed by Mr. Raoul Hafner, was the first rotating-wing aircraft built by the Bristol Company and was also the first British commercial helicopter to fly. A Wasp Junior engine was fitted in this mark.

20. Type 171 Mk.II. 1949. The power unit of this four-passenger helicopter is a 550 h.p. Alvis Leonides. Various detail improvements have also been incorporated. The production model is designated Mk.III.

21. Type 175. On order for B.O.A.C., this large commercial machine (span, 140ft) can have either Centaurus 663 piston engines or Proteus turboprops. With Proteus it will carry a payload of 17,610lb for 2,647 miles at 339 m.p.h. at 29,000ft.

22. Type 167 (Brabazon I). 1949. The story of this, the largest British aircraft, was fully related in *Flight* of September 29th, 1949. It was first flown by Mr. "Bill" Pegg on September 4th, 1949, and made its first public appearance at the S.B.A.C. Display on September 8th. Span, 230ft; wing area, 5,317 sq ft; gross weight, 290,000lb. The Brabazon I is the piston-engined forerunner of the Proteus-powered Brabazon II.

PROJECTS FROM THE PAST

MANY readers will be interested to learn of Bristol aircraft types which, because of policy changes or for other reasons, never progressed beyond the project, drawing-board or early constructional stages. Commencing in each case with the type number, these are identified below:—

7 **(F.3A).** Three-seater fighter. Tractor biplane. 250 h.p. Rolls-Royce engine. Single-engined development of T.T.A., Type 6.

9 **(R.2A).** Two-seater tractor biplane for reconnaissance. 120 h.p. Beardmore engine. First thoughts on F.2A.

18 **(Scout E).** Single-seater tractor biplane Scout with 200 h.p. Ricardo-Halford cruciform engine.

19. Single-seater pusher biplane Scout. Ricardo-Halford cruciform engine.

22 **(F.2C).** Two-seater tractor biplane for fighting and reconnaissance. 200 h.p. Salmson radial engine.

22A. Another F.2C variant, to take the 320 h.p. A.B.C. Dragonfly engine. Later developed into the Badger.

22B. Similar to Type 22, but with B.R.2 rotary engine. (250 h.p.)

31 **(Grampus Mk. I).** Single-engined tractor biplane for passengers or cargo. Siddeley Tiger engine (500 h.p. double Puma).

33 **(Pullman (40)).** Forty-seater passenger triplane. Four Siddeley Tiger engines in central engine room driving twin tractor airscrews. Forerunner of the Tramp (Type 37).

34 **(F.2B seaplane).** Three-seater tourer with float undercarriage. Wolseley Viper engine.

35. Two-seater biplane float amphibian for shipboard use. Jupiter engine. To same Spec. as Fairey Pintail and Parnall Puffin.

38 **(U.S.A. A.H.2).** Two-seater fighter biplane with float undercarriage. Wolseley Viper engine.

39 **(A.H.1).** A single-seat version of the above.

41. Two-seater tractor biplane seaplane with 120 h.p. Beardmore engine. Tourer variant for use in Canada.

42 **(Grampus Mk. II).** Four-seater commercial tractor biplane with 140 h.p. R.A.F. 4A engine. Smaller version of Grampus I.

43 **(Grampus Mk. IV).** Eight-seater cargo or passenger biplane with four Lucifer engines.

44 **(Tramp Boat).** Tractor triplane flying boat with four Siddeley Pumas in central engine room.

45 **(Scandinavian Tourer).** Tourer version of Type 40. Two-seater tractor biplane with wheel or ski undercarriage and Siddeley Puma engine.

49. Three-seat tractor biplane tourer. Lucifer engine.

50 **(Mail Carrier).** Pullman variant. Designed for mail-carrying and having two tractor and two pusher propellers driven by four Liberty engines.

51 **(Lucifer Boat).** Four-seater pusher biplane flying boat with Lucifer engine.

54. Single-seat tractor monoplane with float undercarriage and Jupiter engine.

55. Long-range bomber. Tractor biplane with Rolls-Royce Condor engine.

56. Twin-engined tractor biplane troop carrier, with two Napier Lion engines.

57 **(Grampus Mk. V).** Tractor biplane for commercial use. Two 200 h.p. Hall Scott engines. As Grampus IV, with alternative engines.

58. Tractor biplane for commercial use. Eight seats. Liberty engine. Developed into Type 62.

59. As above, but with Jupiter engine. Developed into Type 75.

60. Three-seat cantilever tractor monoplane with Lucifer engine.

61. Three-seat amphibian monoplane with Jupiter engine driving pusher propeller.

63 **(5 h.p. Monoplane).** Single-seater sporting monoplane designed for an engine of 5 h.p.

64 **(Speed Monoplane).** High-speed single-seater tractor monoplane designed for a 3,000 h.p. engine.

65 **(Man-powered Aeroplane).** A pusher biplane designed to be driven by human power.

(N.B.: Types 63, 64 and 65 were design-studies for lecture purposes.)

66 **(Hydrovane Boat).** Single-engined flying boat with twin pusher propellers and hydrovanes. Napier Lion engine.

67. Two-seat tractor biplane for fighting and reconnaissance. Napier Lion engine.

68. Three-seat tractor biplane for Fleet gunnery spotting. Napier Lion engine. Same Spec. as Avro Bison.

69. Two-seat tractor biplane for reconnaissance. Napier Lion engine.

70. Two-seat tractor monoplane for reconnaissance. Napier Lion engine.

71. Three-seat tractor triplane for coastal defence. Napier Cub engine. Same Spec. as Blackburn Cubaroo.

74. Twenty-six seater tractor triplane for commercial use. Three Jupiter engines. Same Spec. as A.W. Argosy.

80. Two-seat tractor monoplane fighter with Jupiter engine. Monoplane version of Fighter C, Type 78.

82. Coastal defence tractor biplane with two Napier Lion engines. Same Spec. as Avro Ava.

86A. Projected three-seater version of Rolls-Royce Tourer.

87. Three-seat tractor biplane for Fleet reconnaissance. Alternative amphibian undercarriage. Jupiter engine. Same Spec. as Fairey Ferret and Short Sturgeon.

94. Single-seat pusher biplane fighter. Jupiter engine.

97. Commercial biplane with Jupiter engine. For Imperial Airways. Same Spec. as D.H.61.

98. Single-seat sporting aircraft with Bristol Cherub engine. Cleaned-up derivative of Brownie.

100. Commercial tractor biplane for Imperial Airways. Two Jupiter engines. Same Spec. as D.H.66.

102A. Single-seat fighter biplane with Jupiter engine. Derived from Badminton.

102B. Floatplane version of above.

103. High-speed single-seater monoplane with Mercury engine.

104. Single-seater light monoplane with Cherub engine.

106. Two-seat general purpose biplane (D.H.9A replacement) with Jupiter engine.

108. Biplane heavy bomber with two Jupiter VII engines. Spec. B.19/27.

111A. Commercial monoplane with three Jupiter engines.

111B. Smaller version, with three Titan engines.

112. Single-seat low-wing monoplane fighter with 37 mm C.O.W. gun and Mercury III engine. Spec. F.29/27.

113. Commercial biplane with three Jupiter XI engines. For Imperial Airways. Same Spec. as H.P. Hannibal.

114. Commercial biplane with Jupiter XI engine. Larger version of Type 110A.

115. Monoplane troop carrier wtih three Jupiters. Spec. C.16/28.

116. Biplane troop carrier with three Jupiters. Spec. C.16/28.

117. Twin-engined biplane freighter. Two Jupiters, similar to Vickers Vellore.

119. Trainer development of Bulldog, but with greater wing area. Mercury engine. Preceded Type 124.

121. Two-seat general purpose biplane with gun turret. Spec. G.4/31. As Type 120, with torpedo added.

122. As Type 121, but with pilot's cockpit forward of leading edge.

125. Two-seat low-wing monoplane for general purposes. Spec. G.4/31. Variant of Type 122.

126. High-wing version of above. Variant of Type 122.

127. Single-seat fighter tractor monoplane with Rolls-Royce Kestrel engine. Spec. F.7/30.

128. As above, but with Mercury engine.

129. Single-seat fighter. Pusher monoplane. Mercury engine. Spec. F.7/30.

(N.B.: Types 126, 127, 128 and 129 were alternatives to Types 123 and 133.)

131. Twin-engined monoplane bomber. Pegasus engines. Spec. B.9/32.

132. Two-seater low-wing monoplane fighter with Hydra engine. Construction started but cancelled.

134. High-speed tractor monoplane designed for mail-carrying and powered with a Pegasus engine.

135. Commercial monoplane with two Aquila engines. First layout. Developed into Type 142/143.

136. Monoplane bomber with Perseus engine. Spec. P.27/32.

137A. Twin-engined 14-seat airliner. Development of Type 130.

137B. Twin-engined freighter and passenger aircraft. Development of Type 130.

139. Biplane freighter with Pegasus engine. For Canada. Civil version of Type 122.

140. Two-seater monoplane fighter with Perseus engine driving pusher propeller. Spherical nose turret. Spec. F.5/33.

141. Three-seater monoplane fighter with two Aquila engines and a spherical nose turret. Spec. F.22/33.

144. Twin-engined monoplane bomber to Spec. B.3/34. Perseus engines. Bomber development of Type 130.

145A. Long-range monoplane with twin Phœnix engines.

145B. Alternative version of above.

147. Two-seater fighter monoplane with four-gun turret and Perseus engine. Spec. F.9/35. Same Spec. as B.P. Defiant.

150. Twin-engined torpedo bomber (shore-based) with Perseus engines. Spec. M.15/35. Development of Blenheim.

151. High-speed aircraft with Hercules engine. Spec. 35/35 Design study only.

153. Single-seat day and night fighter with Hercules engine. Spec. F.37/35. Fighter version of Type 151.

154. Four-engined high-wing monoplane for civil use. Twenty-four passengers. Four Aquila engines. Similar to Avro 642. Replacement for Fokker F.VII.

155. Twin-engined composite bomber with two Taurus engines. Spec. B.18/38. Developed into A.W. Albemarle.

158. A "slim-fuselage" development of the Beaufighter.

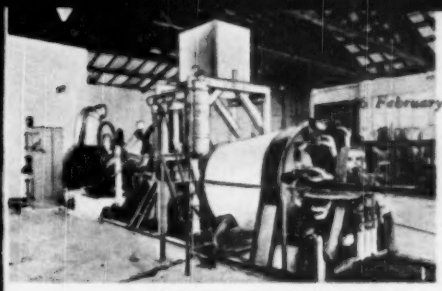
159. Long-range bomber with four Hercules engines and 4-cannon turrets. Spec. B.1/39. Construction started but cancelled in 1940.

161. Bomber derivative of Beaufighter with two Hercules or Griffon. Spec. B.7/40. Developed into Buckingham.

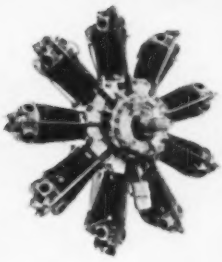
162. Single-engined close-support bomber with Mercury engine. Spec. B.20/40.

165. Brigand Mk. II (trainer) with two Centaurus engines. Alternative to Buckmaster.

169. Photographic reconnaissance version of Buckingham for use in S.E. Asia. Cancelled.



TYPE AND TIME: In this review the illustrations of engines are grouped according to type rather than in strict chronological order



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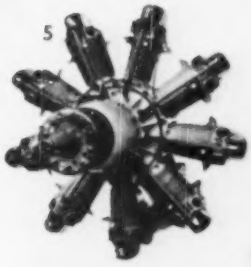

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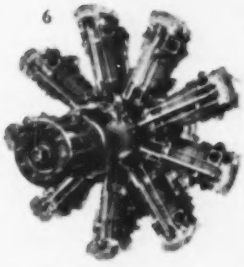
BRISTOL ENGINES FROM 1921



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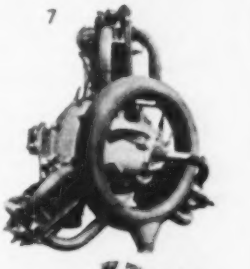
1. **Jupiter III. 1922.** This unit is seen on the dynamometer, and the picture may be compared with the view of the Coupled Proteus on p. 231.
2. **Experimental Jupiter. 1921.** The earliest existing photograph of a Jupiter.
3. **Jupiter. 1922.** Jupiters of this period were conservatively rated general-purpose engines: the model shown was the first to have compensated valve gear.
4. **Jupiter (Exhaust Turbo). 1922.** Bristol foresight and ingenuity are typified by this experimental Jupiter fitted with a turbo supercharger.
5. **Jupiter VIII. 1927.** This Jupiter first incorporated bevel-epicyclic reduction gear of the successful type patented by the brothers Farman in France.
6. **Jupiter X F.B.M. 1930.** One of the last of the great Jupiter family. The "F" series of Jupiters, with forged cylinder heads, was introduced in 1929.
7. **Lucifer. 1923.** Especially suitable for trainers, this 3-cylinder unit was originally rated at 118 h.p.
8. **Lucifer IV. 1927.** A geared Lucifer development of 140 h.p.
9. **Cherub I. 1922.** The 33 h.p. Cherub I was the smallest Bristol engine and was developed from a flat-twin stationary unit. Capacity, 1,095 litres.
10. **Geared Cherub III. 1925.** This unit gave 36 h.p. and, together with direct-drive Cherubs, was used in a variety of light aircraft.
11. **Mercury I. 1926.** This was a short-stroke engine of 24.9 litres, whereas the Jupiter was 28.7 litres. A special "Schneider" Mercury gave 808 h.p.
12. **Mercury III. 1929.** Like other early Mercurys, this was little publicized.
13. **Short-stroke Mercury. 1930.** The overall diameter was only 47in, but although the engine performed well, the larger Mercury was favoured.
14. **Mercury IVS. 1933.** A geared and highly supercharged unit of 645 h.p.
15. **Mercury VIII. 1937.** This engine was the first type to be built in the Shadow Factories, and was widely used in the Blenheim.



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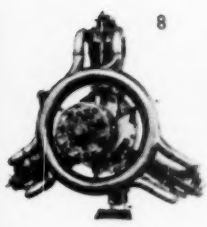

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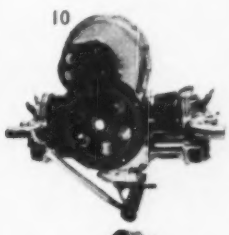

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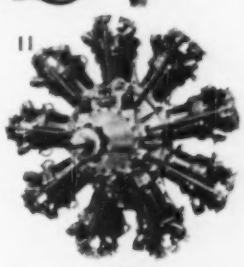

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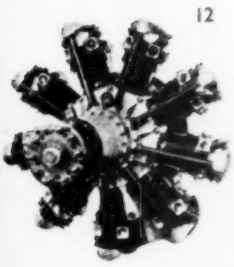

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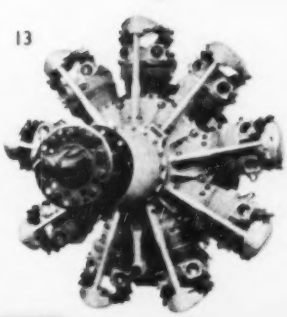

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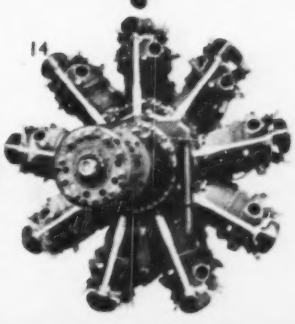

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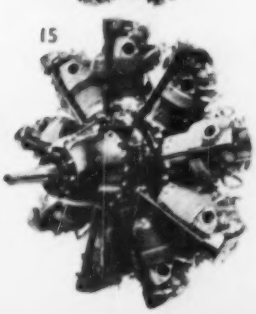

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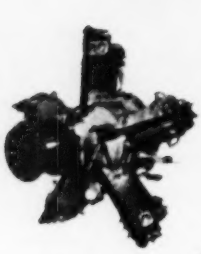
BRISTOL CAVALCADE . .



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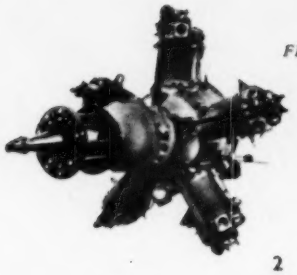

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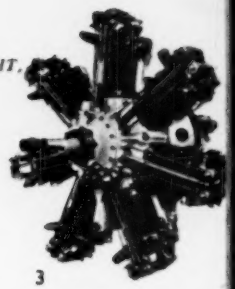

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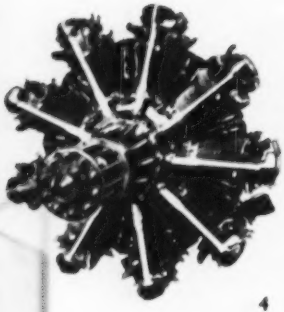

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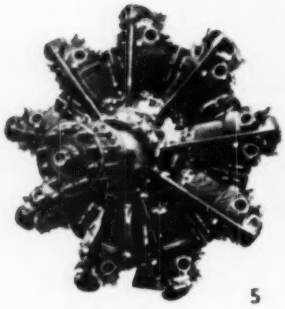

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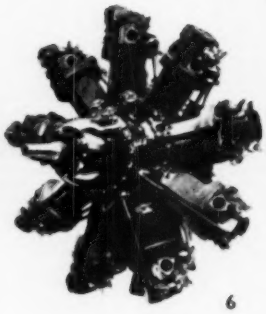

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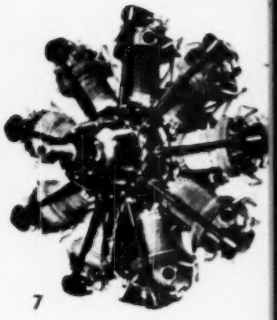

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1. Titan I. 1927. A 5-cylinder unit, the 200 h.p. Titan was of 13.8 litres capacity and used the same cylinders as the later and larger Neptune.

2. Geared Titan III. 1929. A straight-forward adaptation of the direct-drive type. Development of both this engine and the Neptune was discontinued because of the small amount of attention devoted to medium-sized transport aircraft.

3. Neptune. 1929. The 300 h.p. 7-cylinder Neptune was of 19.1 litres capacity.

4. Pegasus I. 1932. An engine of Jupiter capacity, but with Mercury-type cylinder heads and various other refinements, completed a type-test at the end of 1930. After development, this emerged in 1932 as the Pegasus I.

5. Pegasus III. 1933. A medium-supercharged unit of 750 h.p. and one of the first engines to be type-tested on the then-new 87 octane fuel.

6. Pegasus X. 1935. The Pegasus X series delivered up to 960 h.p. but weighed only some 15lb more (1,015lb bare and dry) than the previous series, due to the use of new light alloys and improved manufacturing techniques.

7. Pegasus XVIII. 1937. First of the Pegasus engines to be fitted with a two-speed supercharger. Output, 1,000 h.p.

8. Orion. 1926. A wholly experimental 9-cylinder engine, which was fitted with exhaust-driven turbo-supercharger.

9. Phoenix. 1932. A compression ignition development of the Pegasus. Output, 485 h.p. at 2,000 r.p.m. on a standard grade of crude-oil fuel. In May, 1934, a Phoenix Wapiti gained the world's height record for C.I. engines, reaching a height of 27,453ft.

10. Draco. 1932. An experimental development of the Pegasus with direct petrol injection.

11. Hydra. 1933. An 18-cylinder experimental unit with camshaft valve operation and cylinder heads cast in pairs.

12. Perseus I. 1932. The first of the outstandingly successful Bristol sleeve-valve engines, the Perseus was officially rated at 580 h.p. at 2,300 r.p.m. Capacity: 1,520 cu in.

13. Perseus II. 1934. A civil version of the Perseus, the Series II completed a 100-hr official type test during October, 1934, at the conclusion of which the company submitted it to a successful repeat test.

14. Perseus XII. 1938. A moderately supercharged unit delivering 905 h.p. at 6,500ft. The civil rated version (XIIC) was installed in three types of commercial aircraft.

15. Aquila III. 1938. Development work on the 9-cylinder sleeve-valve Aquila, of 950 cu in capacity, was started in 1933-34. The Aquila III is representative of later units.

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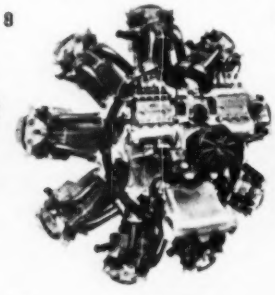

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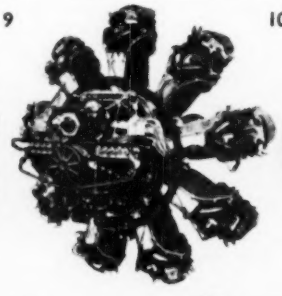

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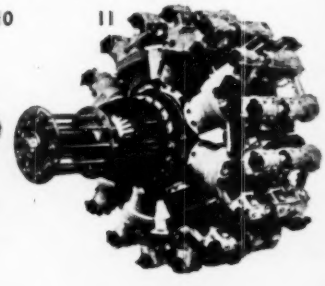

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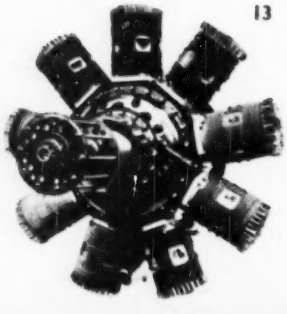

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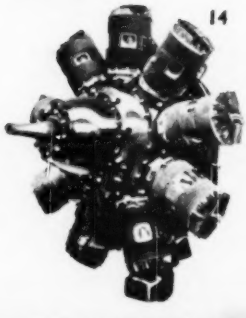

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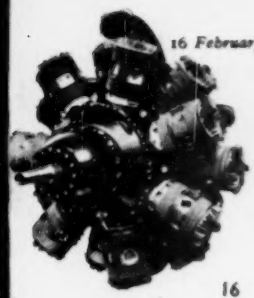

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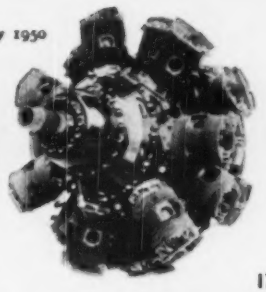

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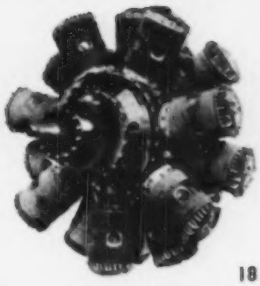

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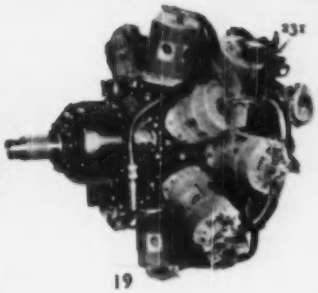

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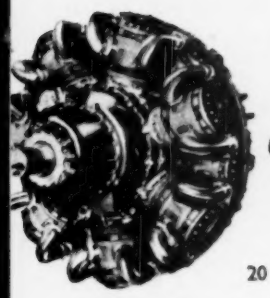

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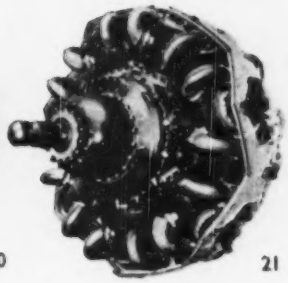

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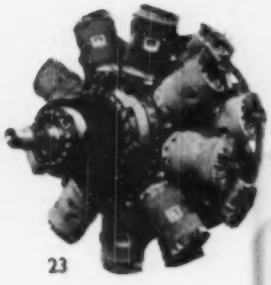

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16. Taurus. 1936. The first example of this 14-cylinder sleeve-valve unit is illustrated. The diameter was only 46½in, but the output was 1,065 h.p. at 3,225 r.p.m.

17. Taurus II. 1938. A medium-supercharged unit giving 1,065 h.p. at 5,000ft.

18. Hercules. 1935. Depicted is the first of the Hercules series of 14-cylinder, two-row, sleeve-valve radials. Type-tested at 1,375 h.p.

19. Hercules VI. 1942. The Hercules VI ran on 100/130 grade fuel and gave 1,675 h.p.

20. Hercules 100 and 630. 1944/46. Representative of wartime and post-war Hercules.

21. Hercules 230 and 730. 1947. The Hercules 230 was a single-speed engine with copper-based heads and stiffened power section. The 730 had a new front cover and reduction gear.

22. Hercules 763. 1948. Rated on 115/145 grade fuel; 2,185 h.p. at 5,250ft.

23. Centaurus. 1938. The engine shown is the first 18-cylinder, two-row, sleeve-valve Centaurus. Largest (53.6 litres) Bristol piston engine.

24. Theseus 501. 1949. In the Theseus turboprop compressor- and airscrew-driving turbines are mechanically independent. Max. power, 1,975 s.h.p. plus 715 lb thrust.

25. Centaurus 18 and 57. 1945. These two-speed supercharged engines differed in reduction gear ratio. The Centaurus 57 had provision for methanol/water injection.

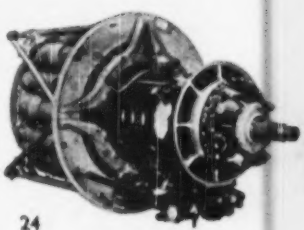
26. Centaurus 661. 1949. This is the latest Bristol sleeve-valve engine.

27. Centaurus V. 1944. A typical Centaurus engine of wartime production.

28. Proteus. 1949. The Proteus turboprop has a 12-stage axial compressor followed by a centrifugal stage, eight combustion chambers and two turbines. Power, 3,200 s.h.p. + 800 lb thrust.

29. Coupled Proteus. 1949. Intended for the Brabazon II and Saro Princess, the Coupled Proteus is now undergoing intensive development.

*N.B.—**Recent units not depicted are the Janus, a small turboprop, development of which has not been pursued, the Coupled Centaurus as now flying successfully in the Brabazon I, and the Phoebus, a development turbojet for the Proteus.***



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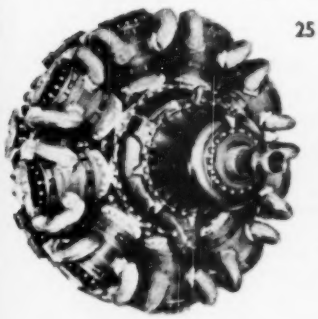

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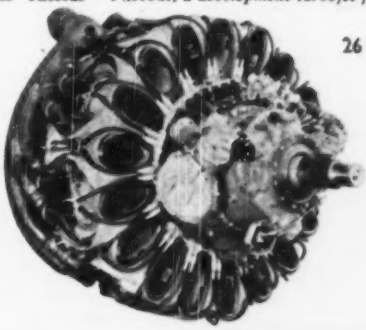

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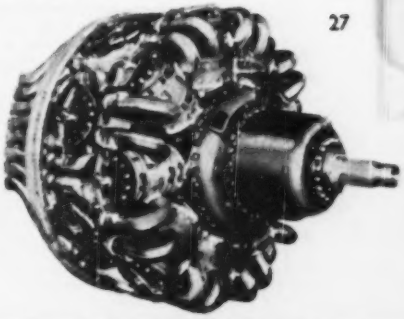

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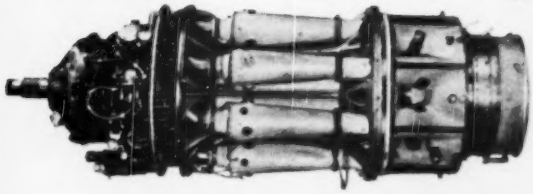

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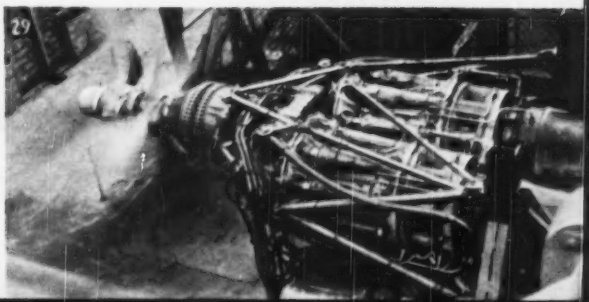
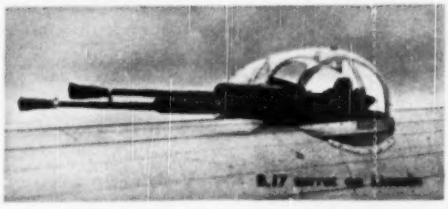


29

BRISTOL ARMAMENT DEVELOPMENT

FROM the earliest days Bristol designers have been up to the minute with aircraft weapons. It appears that bombs were first dropped in the Italo-Turkish war in Tripoli during 1912, and in the following year they were used at the siege of Adrianople, in the Balkan war. At this time the Roumanian Army was flying Bristol T.B.8 biplanes, and several of these were equipped with an automatic device for the dropping of small bombs.



Guns were not fitted to aircraft—except as afterthoughts—until late 1915, and in the early days of World War I many ingenious ideas were tried out in the way of lashed-up carbines, machine guns and even such small artillery as duck-guns firing chain-shot. Some of these were fitted to the early Bristol Scouts C and D, but the problem of firing through the airscrew disc was not solved until the interrupter gear appeared. This was applied to most tractor aircraft in 1916, but the gun remained an external attachment until Captain Barnwell designed the Bristol Fighter literally round a submerged Vickers gun. The observer had one or two Lewis guns on a standard Scarff ring (Bristol always built their own rings), and this type of mounting continued in service until about 1930, when it became apparent that better protection and some power assistance would soon be required to counteract the effect of higher speeds. Bristol's first move was seen in Type 120, which carried an enclosed turret. Various methods of improving rotation were investigated, and in 1935 the prototype Type 130 appeared with a barrel-type front turret, carrying a Lewis-gun mounting balanced by the gunner's weight, and rotated by hand-operated gearing. A further improvement was proposed in the shape of a flywheel-operated servo mechanism as a means of obtaining rapid traversing.

After the beginning of the rearmament drive of 1935, attention was directed to hydraulic controls for turrets, and a design was developed for the Blenheim. This was the first officially accepted hydraulic turret and was designated Type B.I, Mark I. It carried a Lewis gun and had spade-grip control handles. Later a straight handle-bar control was fitted and the turret became B.I, Mark II. Before going into production this was superseded by the similar Mark III carrying a Vickers "K" gun, installed in the majority of Blenheims up till 1939. After the outbreak of war, the R.A.F. called for increased fire power and a prototype Mark IIIA turret with two "K" guns was built, but was eventually abandoned in favour of the Mark IV with twin Browning guns, which became standard on all front-line Blenheim IVs. The Mark IVF was designed to fire forwards and was experimentally installed in two Blenheim night fighters. Later developments of the B.I. turret were the Mark V for the Beaufort, and the Mark VI fitted to Anson gunnery trainers. Mark VE was an Australian variant carrying two 0.5in Brownings.

The second hydraulic turret design was the B.II, which was produced for the nose position of the production Bombay and was entirely different from that on the prototype Type 130. The B.III turret was a similar design for the tail position of the Bombay.

Late in 1937 a mid-upper turret was required for the Beaufort and Bristol were keen to make this a twin-Browning design. However, the Air Ministry decided to retain the "K" gun and the B.IV Mk. I was the result. Later this was adapted (as the B.IV Mk. IE) to mount two "K" guns. A prototype B.IV Mk. II turret carrying twin Brownings was also built but did not go into production. Concurrently with the B.IV, a hydraulic pillar turret, the B.V, was designed for the Type 148 monoplane.

During the summer of 1938, the Air Ministry asked for a day-bomber development of the Beaufort. For this project, the first Bristol cannon turrets (B.VI and B.VII) were designed. Both were under-defence turrets mounting twin 20mm Hispanos, having 60-round magazines. In January, 1939, the company tendered for the construction of a four-engined bomber (Type 159), to carry two large turrets, one dorsal and one ventral, each mounting four 20mm guns. The Bristol tender was accepted and detail design of the turrets (B.VIII-upper, and B.IX-lower) began. No satisfactory continuous feed for the Hispano cannon existed at that time and three separate schemes were examined, all recoil-operated. About this time the Beaufighter was also being designed and it was intended to adapt the continuous feed to the four-cannon installation of this aircraft. However, the Type 159 was cancelled in 1940 when the turrets were half completed, and in spite of the success of trials of the Bristol feed, it was officially decided to standardize the Mark I feed.

During 1940 an all-hydraulic twin-Browning turret—the B.X—was designed for the Blenheim V; it had complete rotation and accommodated a Mark Ic gyro sight. Later the same year, the company was asked to design a four-Browning turret based on the B.I and fitting the same 30-inch diameter ring. This, the B.XI turret, was intended for the Mosquito, but after two prototypes had been built and tested, it was decided not to arm the Mosquito bomber for defence.

Early in 1941 three turrets were designed for the Buckingham. They were a dorsal turret (B.12), an under-defence turret (B.13) and a remotely controlled nose mounting for four Brownings (B.14).

Until the U-boat menace became serious in 1942, Coastal Command had been using fixed 20mm cannon on Liberators and heavier weapons had been designed. Originally an adapted 40mm Bofors had been contemplated, but guns of similar calibre were designed by Vickers and Rolls Royce. A prototype Beaufighter was equipped with a Vickers "S" and a Rolls Royce "B.H." in place of the usual four cannon, and successful firing trials were performed. The Vickers "S" was fitted to Hurricanes and, after initial experience had been gained, Coastal Command proposed to install it in anti-submarine aircraft. Bristol's part in this scheme was to design a new nose section, including an underslung gunner's position, for a Fortress II, to carry a Vickers "S" gun in a powered mounting. This turret, the B.16, was all-electric.

In 1943 two new bombers—the Lincoln and Windsor—were being planned. Bristol designed turrets for both—the B.17 for the Lincoln's dorsal position, and the B.18 and B.19 for the Windsor's tail position, the last-named mounting four 0.5in Brownings and the others twin 20mm cannon. The Windsor turrets were abandoned in favour of Vickers' own remotely controlled barbettes, but a large number of B.17s were produced for the Lincoln.

The last Bristol armament designs which may be mentioned are the B.20 and B.21 rear defence mountings, which are not, strictly speaking, "turrets." The B.20 was a mounting for a single hand-held 0.303in Browning gun for the observer on the Beaufighter X, and was produced in large numbers. A further development of this mounting, to carry a single 0.5in Browning gun, is fitted to the Brigand B.I and is known as the B.21.

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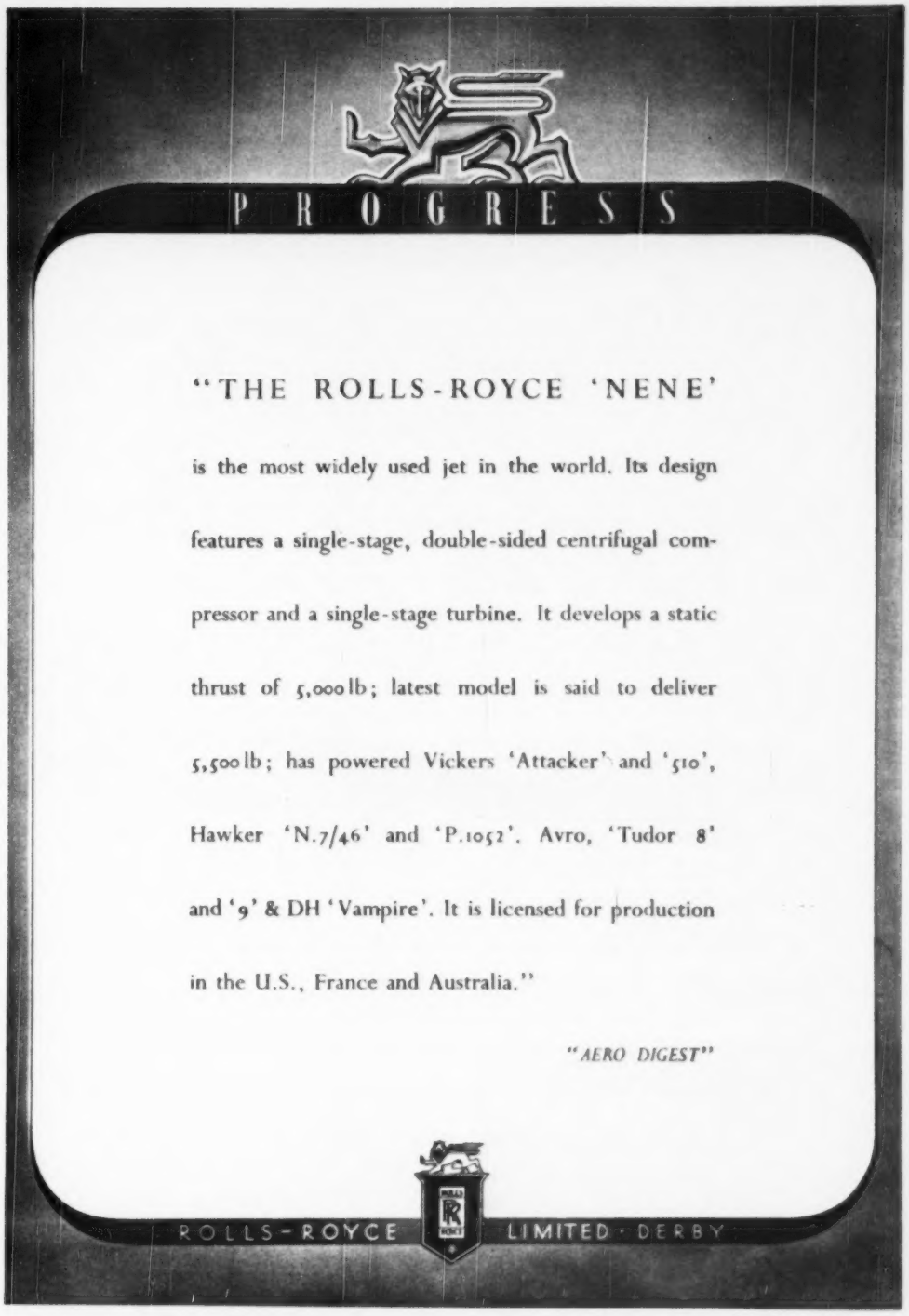
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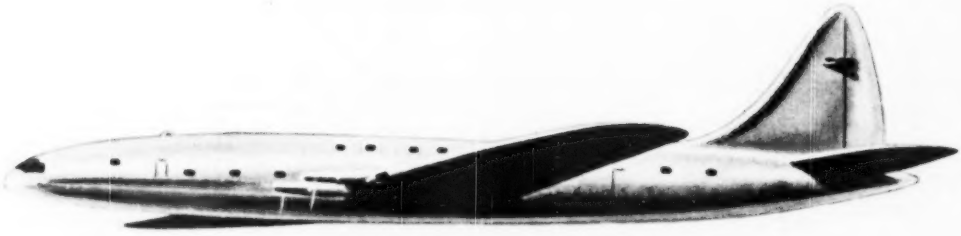

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INTRODUCING THE HERON

First Details of de Havilland's 14/17-seat Four-engined Feederliner

ALTHOUGH the need for a Rapide replacement has been a topic of discussion in airline circles for many months past and, more recently, tenders for the new specification for a somewhat larger aircraft have been announced, the existence in an advanced stage of construction of the first de Havilland Heron has been a well-kept secret.

The Heron is more properly considered as a replacement for the D.H.86, and it bears the same relationship to the Dove as did the 86 to the Dragon Rapide. The makers believe that the Heron (which has been referred to somewhat inelegantly as a "blown-up Dove") will be well suited to take over the duties of the Dakotas now operating on many feeder-line services. The Dakotas are a little on the large side and not quite economical enough for many operators, while, in addition, they are unable to operate safely from several of the small fields which are all that is available on some routes.

Many of the Heron's components are interchangeable with those of the Dove, of which aircraft no fewer than 300 have now been sold for use in 29 countries—bringing in, incidentally, export orders to the value of £6 million. At the end of the war the need for replacements for both the Rapide and D.H.86 was foreseen, but as both could not be attempted together the smaller one, the Dove, was built first and flew on September 25th, 1945.

The Heron, though larger, is somewhat simpler than the Dove, having unsupercharged, ungeared 250 h.p. Gipsy Queen 30 engines with non-feathering airscrews. The standard version has fixed nosewheel landing-gear and no hydraulics. Take-off performance will be comparable with that of the Dragon Rapide. The use of four engines enables a standard of engine-out performance to be offered which could not easily be obtained with economy in a twin-engined aircraft of similar size. A second version of the Heron, with retractable undercarriage, is to be offered for longer-stage services.

Before reviewing the aircraft in detail it may be well to mention its capacity and performance in order to give an idea of its capabilities. It is a 14- to 17-seat four-engined feederliner with a maximum all-up weight of 12,500 lb and with a recommended cruising speed of 160 m.p.h. at 8,000ft. The still-air range with capacity payload of 3,420 lb will be approximately 400 miles, and this gives a corresponding practical stage-length, with S.B.A.C. allowances, of 150 miles. With full tanks—300 gallons—and a payload of 1,750 lb, the maximum still-air range is 1,250 miles, and thus the maximum practical stage-length at this loading is approximately 850 miles.

It may be said that the Heron represents a compromise between, on the one hand, the highest aerodynamic efficiency with its attendant complications and cost and, on the other, the extreme of simplicity with its penalty in speed and payload. The aircraft will meet the British civil air regulations for aircraft in performance group A, and this will ensure compliance with I.C.A.O. regulations. Should it be preferred, however, there is the alternative that the Heron may be certified in the British civil airworthiness regulations of performance group C at an all-up weight of 12,000 lb. At this weight the Heron's best take-off distance (regardless of airline technique) will be 450 yards to clear 50ft.

Details of construction are discussed by Mr. W. A. Tamblin (centre)—who, under Mr. R. E. Bishop, has been largely responsible for Heron design—Mr. Rex King (left) superintendent of the experimental department, and Mr. R. Robson, foreman, experimental assembly.

DE HAVILLAND HERON . . .

Four main advantages are derived from incorporating many Dove components in the Heron: (1) It can be produced quickly from existing tooling; (2) the cost of much new tooling is avoided, with resultant reduction in the price of the aircraft and spare parts; (3) components which are common to both types have been developed through their teething stages in four years of experience; (4) interchangeability will reduce the stocks of spare parts necessary for Dove operators who add Herons to their fleets.

The common components are wings, cockpit, main fuselage, tail units, controls, services and many internal parts. The Dove wing is, in fact, used intact with the addition of root extensions to carry the inboard Queen 30s. Control surfaces are Dove units, unaltered in the case of the ailerons. The fuselage comprises Dove cockpit and tail sections between which is an enlarged cabin comprising extended Dove side panels and keel member, and heightened and lengthened Dove roof member.

As with the Dove, the low-wing configuration and short undercarriage enable the engines and airscrews to be serviced from ground level, while, in addition, loading, refuelling and general servicing are simplified.

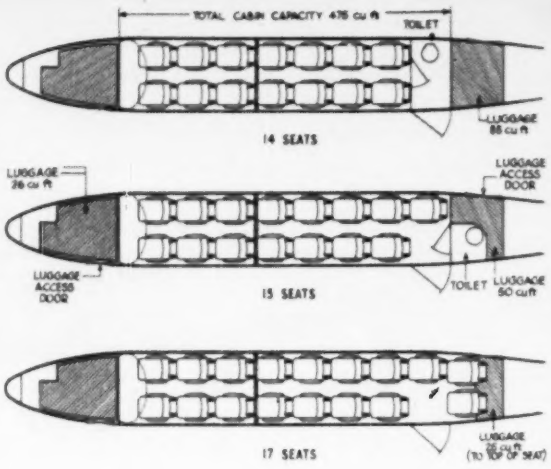
A cost price of £35,000 without radio has been settled for the Heron. The breakdown is as follows:—

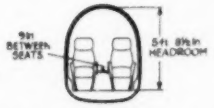
	£
Airframe	24,700
Complete power units (£2,300 each) ..	9,200
Airscrews (£275 each)	1,100
	£35,000
Radio installation	2,200
Total cost ..	£37,200

Construction is naturally very similar to that of the Dove (which was originally illustrated in colour and described in *Flight* of May 30th, 1946). A brief description of the Heron structure provided by the de Havilland Company (for the first machine is not yet completed nor has examination yet been permitted) is given in the succeeding paragraphs.

The fuselage is of a deep oval cross-section constant over the main cabin portion and tapering in plan and elevation to the tail fairing. It is of monocoque construction composed of aluminium-alloy skin reinforced with frames and stringers of vee-section sheet. There are three main longerons on each side of the cabin portion of the fuselage; two above and one below the window line, riveted to the fuselage skin. The main wing pick-up points are located at the fuselage sides.

The nose, comprising the cockpit, the forward freight compartment and the nosewheel mounting, is separated from the cabin by a bulkhead which forms part of the main fuselage structure. A second structural bulkhead is located





Alternative seating arrangements for the Heron. Dove-type seats at 32-inch pitch are used for all the layout.

at the rear of the luggage bay. This has a detachable panel which gives access to the rear fuselage for inspection. There are two further structural bulkheads in the rear fuselage which carry the attachment fittings for the tail. The cabin entrance door is on the port side of the fuselage behind the wing, and three emergency exits are in the roof.

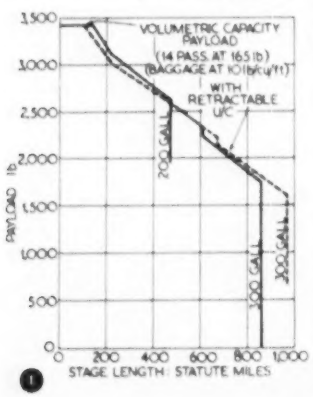
The floor of the main cabin is of sandwich construction stressed for carrying freight. One panel extends from the luggage bay bulkhead to the centre-section spar and the other from the front bulkhead aft to the centre-section spar. The floor is supported on transverse light-alloy members.

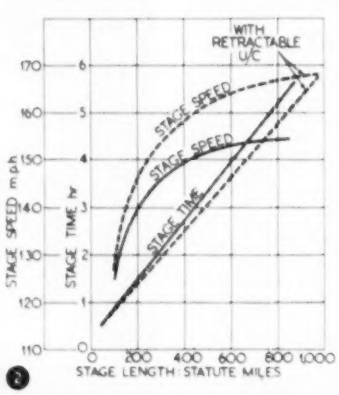
Each wing is a cantilever structure of aluminium alloy with an I-section main spar and a built-up light-alloy false spar to carry the flap and aileron. Forward of the main spar, from the fuselage side to the outboard side of the outer engine nacelle, is another false spar to which the engine bearers are attached. The centre-section spar is a built-up box-section member, integral with the fuselage structure. Ribs and spanwise stringers, to which are riveted the skin panels, complete the structure. The leading edge of the extension wing is a preformed light-alloy skin and is detachable. The wing tips are interchangeable.

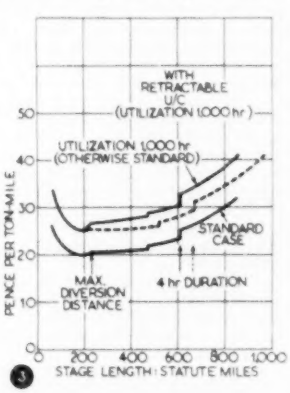
Ailerons and flaps are fabric covered and have light-alloy ribs and sectional spars. The fuel tanks are reached through quickly removable panels on the underside of the wing. Part of the leading edge of each wing hinges up to give access to pipe services, engine controls, and so forth. Both the tailplane and fin are of conventional design, the spars, ribs and skins being of light-alloy. The elevator and rudder are fabric covered.

The main units of the undercarriage are easily removable,

These graphs indicate (1) variation of payload with stage length; (2) variation of stage time and speed with length; (3) direct operation costs and payload with stage length. Breaks in the curves in Fig. 1 are due to the extra weight of tankage for 300 gallons, and in the curves in Fig. 3 to weight of crew's overnight baggage.







are interchangeable port and starboard, and are rubber sprung. The nosewheel has an oleo shock absorber, is fully castering, and has a Marstrand anti-shimmy tyre. Pneumatic wheel brakes are operated by a thumb lever on the control column, with differential steering operated by the rudder pedals. A version with a pneumatically operated retractable undercarriage can be supplied to special order.

Dual control is provided for the crew of two, and the cockpit layout, except for minor details, is exactly the same as that of the Dove. It will be recalled that pilots think highly of the Dove cockpit layout and of the very good all-round view afforded. The cockpit roof is of opaque Fibreglass. Space is provided for the following radio equipment: Marconi AD 97/108 transmitter-receiver, which can be arranged to provide W/T or R/T communication on medium and high frequencies; a Marconi Automatic Radio compass (AD 7092) working on medium and low frequencies; and also for a Standard Telephones S.T.R.12 V.H.F. transmitter-receiver and Marconi blind-approach equipment.

The Gipsy Queen 30 engines and the D.H. 1,000-size 7ft diameter, constant-speed airscrews are well tried and are likely to prove very reliable. Overhaul lives of the two are respectively 750 and 800 hours. The Queen 30 is a straightforward development of the earlier Gipsy Six and is in general use in the Prentice basic trainer, while the airscrews are of the same type as those used on the Prentice and the Proctor.

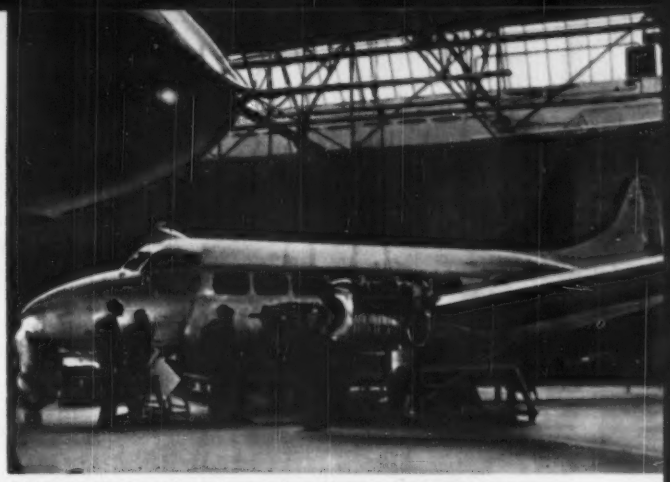
Power and ancillary services are similar to those of the Dove. Flaps and brakes are pneumatically operated, pressure being maintained by Hymatic compressors, one on each outboard engine. The outboard engines also drive two 24-volt 1,000-watt generators which supply the two accumulators stowed in the starboard side of the aircraft nose. Circuit-breakers are used in place of fuses.

The fuel tanks are of a bag type (one on each side of each wing-root spar) and according to requirements may have a total capacity of 200 or 300 gallons. They hold 100 (rear) and 50 gall (front) and have Plessey immersed-type fuel pumps. A cross-feed cock makes it possible for each of the tank-groups to supply any engine.

Inboard engines carry Plessey vacuum pumps to drive the blind-flying instruments and, if fitted, the Sperry gyropilot A.L.I. Air from the pressure side of the vacuum pumps is used to operate the Goodrich wing and tail de-icing boots. The airscrews have fluid de-icing.

The normal cabin layout accommodates 14 passengers, baggage compartment and toilet, but a slight rearrangement of this will enable a fifteenth passenger seat to be fitted. If the toilet compartment is removed and the luggage hold reduced in capacity, the maximum of 17 seats can be accommodated.

The internal width of the cabin is 4ft 6in and the head room for the whole length is 5ft 8½in. Dove-type chairs, which have no rear legs, and therefore give unhindered foot room, are fitted at 32-inch pitch. Fourteen rectangular windows of the same size as those on the Dove will give the passengers a good view and provide good lighting for the cabin. A separate cold-air ventilator is provided for each passenger, and cabin heat is controlled by the pilot.



"Heron folk" give scale to the aircraft in this scene during construction.

Mainly because the Heron is a little larger, the operating costs per ton-mile of payload will be a little less than for the Dove. These costs, in pence per ton-mile, have been estimated by the standard S.B.A.C. method to permit direct comparison with current types of aircraft. The figures for price and engine-life used in preparing the accompanying graphs are those already quoted. In addition, it is assumed that there will be a crew of two, that maximum w.m. power per engine is 193 b.h.p., and that the fuel cost is 1s 8d per gallon. Cruising power is taken as 60 per cent of take-off power.

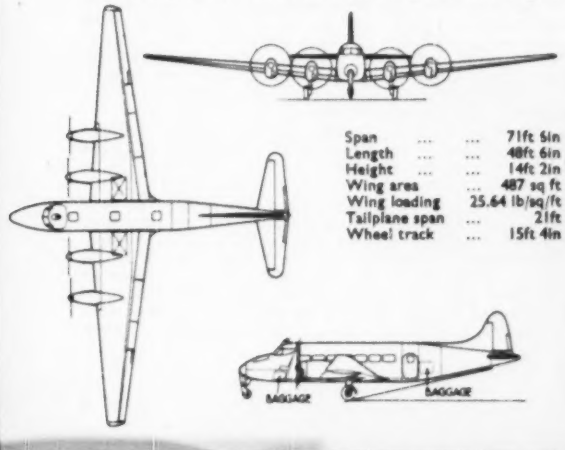
The performance summary for the Heron at 12,500 lb all-up weight in standard conditions and with full standard equipment including radio, is tabulated below. For the version with retractable undercarriage, the recommended cruising speed at 8,000ft on 60 per cent power is 175 m.p.h. The figure for a.m.p.g. is increased from 4.15 to 4.5, and the rate of climb with one engine out is increased from 340 ft/min to 400 ft/min.

PERFORMANCE DATA

Recommended cruising speed at 60 per cent power, at 8,000ft	160 m.p.h.
Corresponding fuel consumption	39 gall/hr
Corresponding air miles per gall	4.15
Max w.m. cruising speed at 3,000ft	177 m.p.h.
Rate of climb at sea level	1,200ft/min
Service ceiling	18,500ft
Rate of climb, 3 engines, at 5,000ft	340 ft/min
Take-off to 50ft in still air from dry grass surface using airline technique	700yd
Take-off distance to 50ft when one engine fails at safety speed (still air, dry grass surface)	800yd
Take-off distance to 50ft at 12,000 lb a.u.w. (still air, dry grass surface)	650yd
Landing distance from 50ft (still air, dry grass surface)	450yd

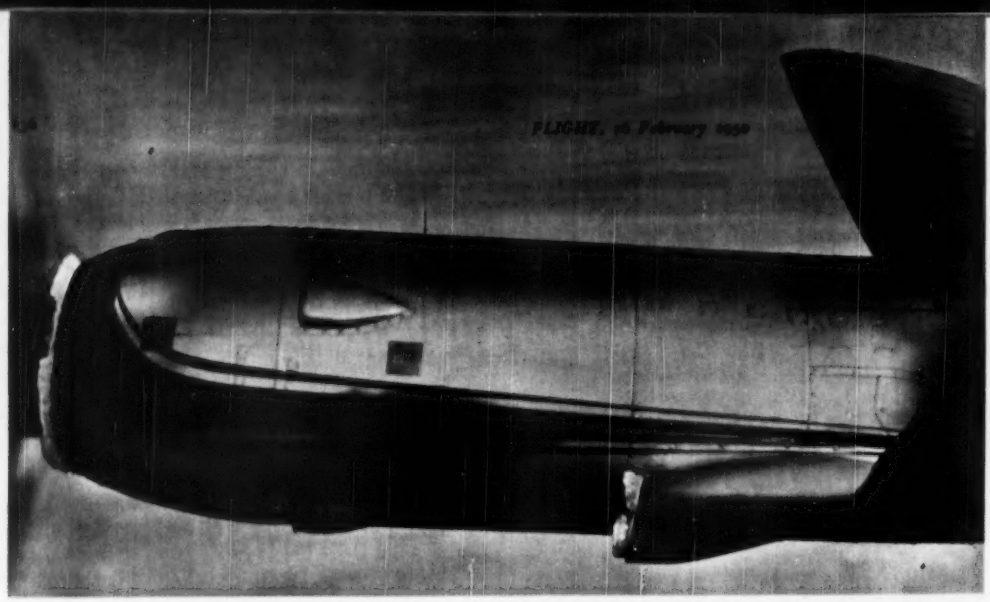
WEIGHTS

Tare weight, including 14 chairs, toilet compartment, and radio	7,960 lb
Crew of two	330 lb
Fuel 183 gall (400 miles stage length with allowances)	1,316 lb
Oil 16 gall	144 lb
Payload	2,750 lb
All-up weight	12,500 lb



Span	...	71ft 6in
Length	...	48ft 6in
Height	...	14ft 2in
Wing area	...	487 sq ft
Wing loading		25.64 lb/sq/ft
Tailplane span	...	21ft
Wheel track	...	15ft 4in

The first Heron nearing completion at the Hatfield factory.



A build-up of ice around the Dart main air intake and a thin-lipped ridge on the de-icing air scoops. The missing piece—some nine inches in length—from around the intake went into the compressor without ill-effect.

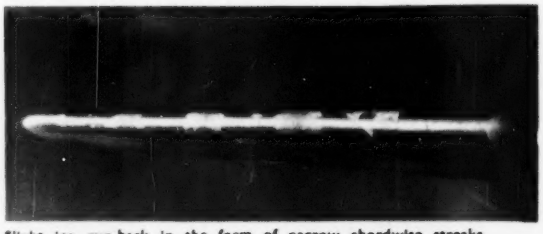
DE-ICING THE VISCOUNT

Hot-Gas Thermal Method Preferred : A Report on the Recent Trial Flights

COMPLETION of a series of flights by the Vickers-Armstrongs Viscount in severe icing conditions was recently reported (*Flight*, January 26th). Now it is possible to give a fuller report of these investigations, which were carried out over the Atlantic Ocean from Shannon Airport and which entailed some ten hours of flying in icing conditions. The Vickers-Armstrongs Company's exhaustive de-icing trials with the earlier Viking aircraft will be recalled (see *Flight*, March 13th, 1947).

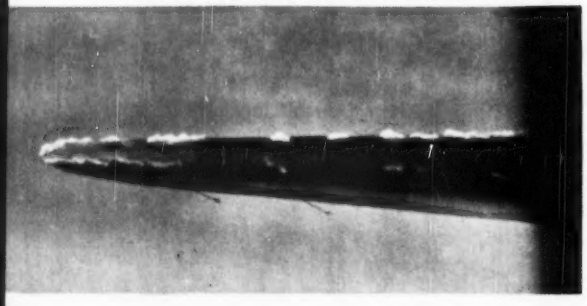
Prefacing the report, the Company states that as a basic principle it believes that an aircraft should be "iceworthy" even if the de-icing system itself is rendered inoperative, thus great care has been taken to ensure that the controls are relatively unaffected, even though there be considerable ice formation on the aircraft. Vickers, it seems, are confident of the comparative immunity from icing of the Rolls-Royce Dart turboprop with centrifugal-type compressor. Had justification been required, it was provided during the recent trials.

After consideration of the various types of airframe de-icing systems, the conclusion was reached that the hot-gas thermal-duct method was superior in almost all respects. Accordingly, the Viscount wing was designed to provide the necessary gap for the transfer of hot gases along the leading edge. A very considerable quantity of heat is required to prevent ice formation under the most severe conditions likely to be encountered, and in the case of the Viscount 1½ million B.T.U.s per hour—the equivalent of about 600 h.p.—must be available.



Slight ice run-back in the form of narrow chordwise streaks sometimes occurred about four minutes after heat was turned on.

This rough build-up of ice around the tailplane leading edge had no effect at all on the control characteristics of the aircraft.



The Viscount mainplane carries a double-skin leading edge extending as far back as 0.15 of the the chord, and the gap between the skins measures ½in. Intermediate spacers —not corrugations—separate the skins. The nose portion of the inner skin forms the curved wall of a D-shaped duct running along the leading edge and, as may be seen in the diagram (p. 237), hot air flows forward through a slot in the duct to the gap between the leading-edge skins and then back into the wing, whence it is exhausted to atmosphere through surface louvres. A similar method is employed for the tailplane and fin.

When the de-icing system for the prototype Viscount was considered, it was resolved to avoid at all costs the use of combustion heaters, and in any case it is logical in an aircraft powered by gas turbines to turn to the jet pipe for the supply of heat. A thermostatic control valve is employed to bring about the mixing of exhaust gases from the jet pipe with cold air; the mixture is then passed at appropriate temperature to the surface heating ducts. Later marks of Darts developed for the production Viscount 700, and a general increase in the overall size and payload of the aircraft have, to quote the manufacturers, "brought in their own train certain developments which

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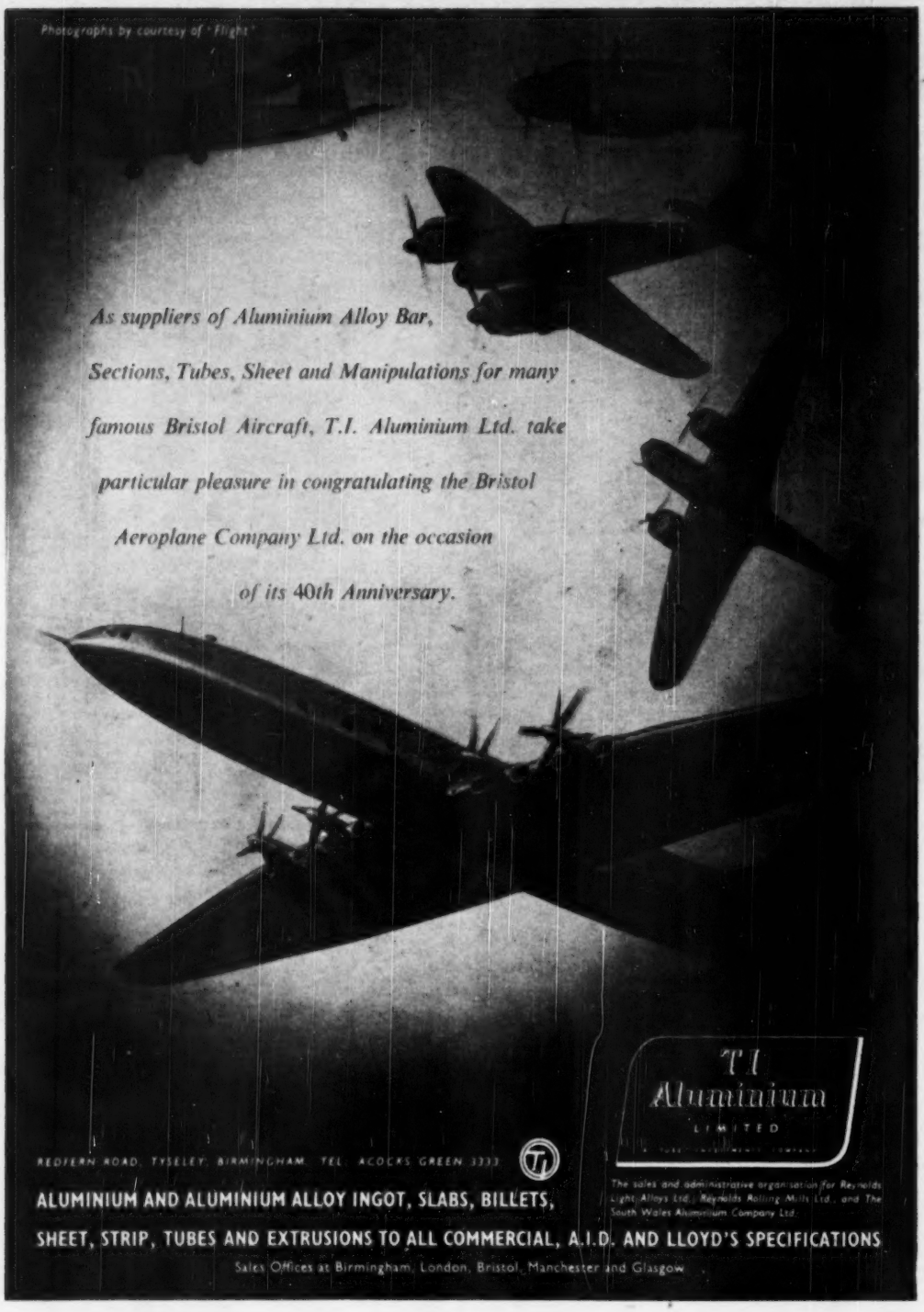

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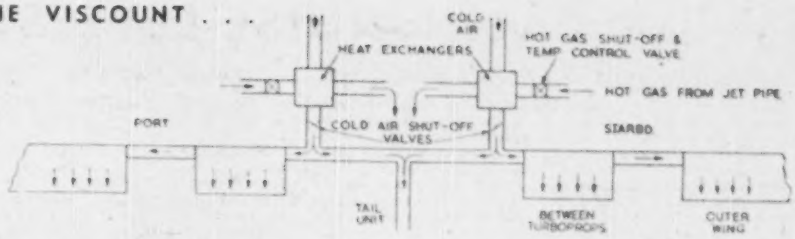
DE-ICING THE VISCOUNT . . .

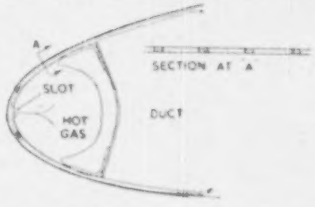


The slightly modified production de-icing system in diagrammatic form. Exhaust-gas heat exchangers are used in place of a simple jet-pipe bleed.

prevent the use of a simple jet-pipe bleed." Exhaust-gas heat-exchangers are therefore used instead. The two systems are illustrated diagrammatically.

In the production version equal efficiency is maintained, but at the same time any doubts about the ducting of exhaust gases through the airframe are eliminated. Flight and laboratory tests so far carried out do not, in any case, indicate that there would be trouble from corrosion or soot caused by the exhaust from kerosene fuel.

So far as the Dart turboprops themselves are concerned, the earlier marks in the prototype, as used on the trials to which the report refers, have no de-icing system. However, to ensure economical operation on the production aircraft, it is intended that the later marks of Dart shall embody thermal de-icing for the intakes to avoid a risk of increased fuel consumption as a result of extreme intake blockage. The airscrew blades on the prototype are de-iced by fluid overshoes, but those on the production machines will be electrically heated.



Section through the leading edge of the Viscount mainplane showing double skin, D-shaped duct, and slot for hot air.

Thermostats and flowmeters were installed in the wings and tailplane during the construction of the Viscount so that the de-icing system could be thoroughly checked during a series of clear-air proving flights, but to augment these tests it was considered desirable to fly deliberately in search of ice. At the appropriate time it was reported by the Meteorological Office that intense icing was likely to be met in the vicinity of Shannon. The main objects of the trial were to study the handling characteristics of the aircraft when carrying a considerable quantity of ice, and to assess the efficiency of the de-icing system in preventing its formation and in removing ice after it had formed.

The report continues: "... in all, four separate flights were made in temperatures varying from 0 deg C to – 18 deg C O.A.T., and at heights between 4,500ft and 15,000ft. Trials were made with main and tail systems on and off alternately and photographs were taken of the results. The accretion of approximately 2in of ice on the tailplane (see illustration on previous page) had no effect on the control characteristics of the aircraft, and the damping effects of both rudder and elevator were very positive. When flying hands-off in bumpy conditions there was no tendency for the control column to move. The ice was of very rough formation, building up 4 to 6in aft of the leading edge, but completely covering the tip.

"When the tailplane de-icer was turned on at the conclusion of this test, the ice began to break up after about four minutes and came away in large pieces without any sign of run-back. Run-back experienced in other tests, at lower temperatures, was in the form of narrow chordwise streaks (as illustrated) causing no adverse aerodynamic effects. On no occasion was there any tendency to form spanwise ridges."

The heading photograph shows the nature of ice formation around the turboprop power units. It is recorded that "a build-up of some 2.3in was observed round the engine air intake and a thin-lipped ridge formed around the de-icing air scoop, as seen in the picture. The large piece, some 9in long, which is seen to have broken off from the engine intake, went into the engine without any harmful effect.

"When the heating to the mainplanes and tail unit was switched on before entering the icing zone, the surfaces remained clear of ice, although on the aerial masts, which are not de-iced, the build-up was quite considerable. Under the coldest conditions encountered (– 25 deg C true temperature) the thermal de-icing system cleared the main surfaces of ice but the fluid de-icing system failed to cope satisfactorily with ice on the windscreen—a significant feature when considered in the light of the firm's faith in the former method."

The Company concludes its report: "As a result of these trials Vickers-Armstrong feel more than satisfied with the behaviour of both the aircraft itself and the thermal de-icing system, especially as the Viscount was flown in conditions considerably more severe than those likely to be encountered during the normal routine operation of high-altitude aircraft of this type. Not only was the thermal system able to dispose of the ice formations deliberately accumulated by entering ice-forming clouds with the system not working, but the machine remained stable and controllable when carrying a fairly heavy build-up of ice.

"Even in the worst conditions encountered, the bulk of the ice was dispersed after the system had been turned on for a relatively short time, and the only remnants of run-back were of such a nature as to be negligible, either from the point of danger or of efficiency."

These trials complete the Viscount prototype test programme, and the aircraft is now with the Civil Flight at Boscombe Down. During its 400 hours of test flying, the prototype has undergone intensive and comprehensive tests particularly, in the later stages, of the pressurizing system. The attainment of 400 hours' flying since the first flight in July, 1948, speaks well for the serviceability achieved on both power units and airframe.

The prototype Viscount received a British normal-category C. of A. last September, but at that time it was without its pressure or de-icing systems. The slightly enlarged Viscount 700s will, of course, have to obtain a separate C. of A. B.E.A.'s 40-seater version will be the model 701 and B.O.A.C.'s the 704.

Assuming that approximately one hundred Viscount 700s will be built, a provisional selling price of £167,000 has been announced. They will probably commence operation on Corporation routes by mid-1952 and reference is made to B.E.A.S. plans for them on page 239.

EUROPEAN TOUR FOR THE VISCOUNT

COMMENCING in the third week of March, the Vickers Viscount is to make a demonstration tour of the principal cities of Western Europe. The aircraft will be demonstrated to airline officials in Amsterdam, Brussels, Zurich, Rome, Madrid, Lisbon, Copenhagen, Stockholm, Oslo and Paris. On board will be Sir Hew Kilner, M.C., deputy chairman of Vickers Armstrongs Ltd., Capt. J. Summers, chief test pilot, and Mr. R. C. Handasyde, sales manager of Vickers Aviation Division.

CABIN NOISE-LEVELS

Ambassador Tests : Pressurization Effects : Piston Engines and Turboprops Compared

IN these days there are signs that airline passengers are beginning to take a greater interest in the aircraft in which they fly and, in particular, to expect improved standards of comfort. Talk of the remarkable silence of pure-jet and some turboprop-powered prototypes, too, is having the effect of making people more noise-conscious, and manufacturers of new aircraft are, quite rightly, having to pay more attention to noise suppression. Analysis of noise in aircraft interiors has shown that both piston engines and gas turbines can give rise to certain frequencies which may cause irritation and fatigue; this is quite apart from the aerodynamic noises produced by the passage of the machine through the air.

Measurement of noise intensity is associated with the particular frequency of the sound, since the human ear is sensitive in varying degrees to sounds at different frequency levels. In an aircraft, the zero to 300 cyc/sec band covers the majority of noises from power units and the ordinary vibration rattles. Soundproofing provides little or no reduction in sound intensity in this band, and the noises must therefore be suppressed at the source. Fortunately, however, sounds of such low frequency are relatively unimportant unless they exceed an intensity of 120 decibels. Most easily heard by passengers are the sounds in the 600-4,800 cyc/sec frequency; these are mainly caused by the effects of airflow and include such sounds as those often caused by venting in the pressurization equipment.

Measurements of the Airspeed Ambassador's noise level, recently made by the manufacturers, gave some useful data. It was found that, although the operation of the recirculating fans and blowers made little noticeable difference, use of the pressurization equipment raised the noise level by 2-3 decibels in the high-frequency range. An increase in r.p.m. and lowering of the boost settings gave a corresponding increase in the sound intensity in the lower frequency ranges. Increased boost (with a consequent higher speed) had the effect of generally increasing the noise intensity associated with aerodynamic causes—the most irritating type of noise from the passenger's point of view.

During the tests the Ambassador was found to show about 90 decibels in the low-frequency band as compared with approximately 80 decibels experienced in turboprop-powered aircraft in a similar category. Within the critical frequency band (600-4,800 cyc/sec), however, it is the makers' claim that there is little to choose in the noise levels of the two classes of aircraft if they are flown at the same speed and if both are aerodynamically clean and well soundproofed.

CANBERRA DESIGNER RESIGNS

THE resignation of Mr. W. E. W. Petter, B.A., F.R.Ae.S., from the post of chief engineer to the English Electric Co., Ltd., is announced by the company, who further state that Mr. F. W. Page, B.A., A.F.R.Ae.S., has been appointed chief engineer in his place.

Mr. Petter, who was previously with Westland Aircraft, Ltd., joined English Electric in 1944, and has been responsible for the design and development of the Canberra. Mr. Page (at one time with Hawker Aircraft, Ltd.) was previously assistant chief designer, and Mr. D. L. Ellis, B.Sc., A.R.T.C., F.R.Ae.S., who now becomes deputy chief engineer, was chief aerodynamicist.

Mr. Petter's resignation was unexpected, and the company will undoubtedly feel the loss of his talents. It is understood that his interest will remain with the aircraft industry, with which he has been connected since 1929, but he is making no plans for the immediate future.

In our description of the Canberra (*Flight*, December 15th, 1949), we remarked that

"Among British aircraft manufacturers, the English Electric Co., Ltd., is unique: diesel engines, electrical equipment of all kinds, locomotives, domestic appliances such as electric stoves and washing machines, tires and radiators, are, with aircraft, things which the company manufacture. In visualizing this fact, it should not be thought that undue emphasis is placed on the activities of the aircraft division; on the contrary, we gained the impression during our visit that, so far as the company *per se* is concerned, aircraft are just another commodity. . . The aircraft division is also, if not unique, at least unusual in having no experimental shop, and in this connection the first Canberra was not a prototype in the normally understood sense of the term."

The success achieved by the company in producing the Canberra we attributed to a happy combination of a good design team (Mr. Petter has expressed his regret "at leaving a splendid team") with English Electric experience of wartime and post-war sub-contract production of military aircraft.

It is understood that certain changes are to be made in the organization of the company's aircraft side in preparation for new designs which, like the Canberra, will be entirely English Electric products.

TRANSPORT COMMAND'S SAFETY RECORD

PRESENTING the Transport Command Accident Prevention Trophy at R.A.F. Station, Oakington, on February 10th, Air Chief Marshal Sir John Slessor, the new Chief of the Air Staff, congratulated the Command on a "really remarkable achievement." It was of the utmost importance, said the C.A.S., not only to the R.A.F. but to air transport as a whole, to dispel the popular illusion that flying was a nasty, dangerous business. He was glad to see a continuing drop in the write-off rate from 2.9 to 0.7 per 10,000 hours flown between 1945 and 1949. It would have been quite reasonable to expect in 1948-49 an upward curve in the accident rate as a result of the Berlin Air Lift; but the curve continued to fall sharply in both years, and the 1949 rate was only 19 per cent of that of 1944.

Against this background, it was necessary to judge the specially creditable achievement of the winners of the Trophy for 1949—Oakington—and of all the squadrons operating from that station. The C.A.S. named these squadrons as Nos. 10, 46, 30 and 27, and added Nos. 18 and 206 from Waterbeach, which, in 1949, operated from Oakington and so shared credit for the Trophy. A rate of 1.4 avoidable accidents for every 10,000 hours flown was excellent. Waterbeach came a good second with a rate of 1.5, and Dishforth were close behind with 1.8.

AIRLIFT SOUVENIR

AIRLIFT BERLIN, a well-illustrated book produced by the Magistrat of Greater Berlin, is now on sale in Germany at a price of eight marks (13s 8d). An English version has also been prepared, and the British Control Commission for Germany has received 500 copies for distribution to R.A.F. and civil personnel who took part in the airlift.

DOLLARS FOR CAMERAS

SPEAKING at the 44th annual dinner of the Williamson Manufacturing Co., Ltd., on Friday last, Mr. Colin Williamson (chairman) pointed out that they now had representation in 24 foreign countries, and that 75 per cent of these were actually receiving Williamson aerial cameras and other photographic products.

Mr. J. E. Odle, assistant managing director, said that during December the Williamson Company of Canada had booked orders totalling 140,000 dollars, mostly for equipment for which good delivery dates could be given.

BLACKBURN APPRENTICES REWARDED

AT the nineteenth annual distribution of apprentices' merit awards, held recently at the Brough factory of Blackburn and General Aircraft, Ltd., it was stated that 69 per cent of the total number of apprentices employed enrolled for evening classes, and of these 57 per cent were successful in their examinations, which showed a gratifying improvement on the previous year. Amongst those successful, two apprentices, Messrs. Kilby and Stoker, gained their Higher National certificates and eleven their Ordinary National certificates. In addition to these, two apprentices obtained their diploma in aeronautical engineering at the Hull Technical College; J. V. Welbourne did well in obtaining the award with distinction.

The Robert Blackburn Scholarship, which is awarded annually to the apprentice who obtains the highest pass in his Ordinary National certificate, was this year awarded to apprentice C. J. Robinson. Mr. Robert Blackburn, O.B.E., chairman of the company, inaugurated this scholarship in 1944, the total value of which is £125, to assist the recipient whilst taking the 2½-year Higher National diploma course in aeronautical engineering.

Addressing 221 apprentices assembled at the distribution, Capt. N. W. G. Blackburn (joint managing director) said: "Your main task is to learn your trade in whatever field your talents lie . . . to be alert, happy and punctual in your job is the best advice I can give you to assure a successful career."

DEVELOPMENT

OF A THEME . . .

Representing the latest development in interceptor aircraft the P1052 has been designed to give an unparalleled combination of speed, rate of climb and range — features of its famous forebears.

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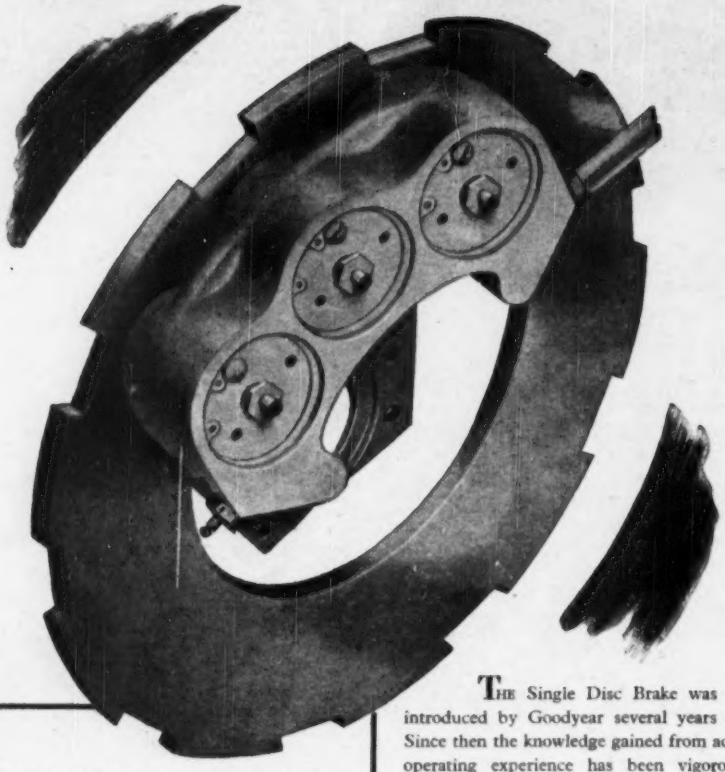

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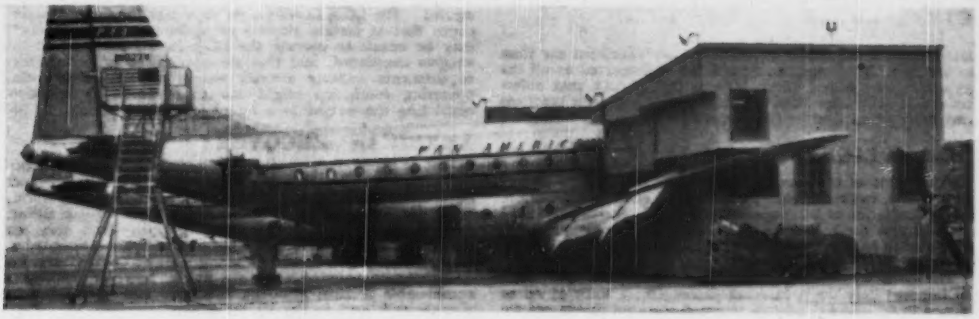


NOT AN OVERSHOOT, but a Stratocruiser in a "nose hangar" at Idlewild. P.A.A. have similar structures at London Airport.

CIVIL AVIATION NEWS

THE B.E.A. FLEET

MR. PETER MASEFIELD, chief executive of B.E.A., has recently given a concise and revealing picture of the Corporation's present and future aircraft fleet. In addition, he has announced new plans for the Marathon, which include a version with a new type of high-lift flap.

"So far as one can foresee at present," says Mr. Masefield (in the current issue of the *British European Airways Magazine*), "our future requirements are:—

"(1) The Airspeed Ambassador, designed to carry up to 49 passengers and to fly on routes of high traffic-density such as between London and Paris. We have 20 Ambassadors on order, the first due to be delivered on January 15th, 1951.

"(2) The turbine-powered Vickers Viscount Type 701, designed to carry 40 passengers and most suitable for our longer routes of lower traffic-density, such as London-Rome. (It will reach Rome in less than four hours non-stop, cruising at up to 300 m.p.h. at 25,000ft.) The first Viscount will probably be with us early in 1952. . . . We shall require somewhere between 20 and 30 Viscounts.

"(3) The Handley-Page Marathon, now intended for our short-haul routes round Scotland and between the Channel Isles, flying with up to 20 passengers. Modified, with new flaps, the Marathon will now serve as our Rapide replacement. Probably 14 will be required to succeed our 20 Rapides.

"(4) A Dakota replacement, an unspecified aircraft not yet either in existence or fully investigated. It is likely to be needed some years hence to replace the Dakota on Channel Islands and other routes where low operating costs over short stages, working from short runways, are the primary requirement. . . . Our 28-passenger Dakotas must all be retired by 1956, and some replacement must be obtained.

"(5) A large and reasonably fast freighter, designed to replace our present Dakota freighters for the development of our cargo routes. This freighter—like our present freighters—ought to be a version of one of our standard passenger types.

"(6) A large helicopter for the future operation of short-haul inter-city routes, such as between Manchester and Birmingham, and Birmingham and London, carrying up to 30 passengers. Such a helicopter cannot arrive until the late 1950s.

"(7) At some time later on, we may need a high-speed jet-type for a few selected routes.

"*New Feederliner*.—For the really short routes of low traffic-density—the feeder and social services—we are now going forward with the H.P. Marathon. The 20-passenger Marathon is, frankly, rather too big for most of our Scottish and inter-Channel Islands routes, on which a 12-passenger aeroplane would be just about right to meet traffic requirements at the desirable frequency of services.

"As you know, we drew up a specification of requirements for a Rapide replacement for these routes. We have received a large number of interesting design tenders. . . . Among the submissions to the requirement is the Marathon in a form modified to enable it to meet the particular airfield and *en route* needs of our Scottish and other short-haul services. By equipping the Marathon with high-lift flaps of increased travel, that aircraft can be made to fulfil the take-off and landing requirements which we need, not only for our present routes but also for certain new services. The Marathon is, as I have said, rather too big for some of our specialized routes, but the Government has already spent something like £2,000,000 on developing this aircraft. Provided the Marathon can be made to meet the operational requirements, it is clearly in the national interest for us to adapt it to our needs, thereby also keeping the number of types in service to a minimum. . . .

"So there is the pattern for our new generation of aircraft—building up an all-British B.E.A. fleet of Ambassadors, Marathons and Viscounts—about 60 aeroplanes altogether, costing some £8,000,000 sterling and able to earn about £12,000,000 of revenue a year. . . . Our amortization charges, including spares, will amount to at least £1,000,000 a year on the new types. We have to earn that amount of money on them before we can start paying the costs of fuel, oil, crew, traffic charges, landing fees and overheads."

CLOUD DETECTION TRIALS

AT the request of the M.C.A., a series of research flights with airborne cloud-and-collision-warning radar is being carried out by B.O.A.C.'s Operational Development unit at Hurn. An interim report has already been compiled on the results obtained with Ekco equipment installed in a Hythe-class flying-boat in the Singapore area, which was considered to offer a sufficiently high incidence of thunderstorm activity. The first half of the trials were intended to test the efficiency of the equipment in detecting, identifying and avoiding cumulo-nimbus cloud. Further tests to determine its use for navigational purposes are now in hand.

Experiments previously carried out on these lines by the Telecommunications Research Establishment and by the R.A.F. Transport Command Unit showed that the turbulent cumulo-nimbus cloud-cores could be detected at ranges of up to 40 miles. The major requirement stressed for such equipment, however, was that the scanner should be gyroscopically stabilized, and the Ekco equipment installed in the Hythe now employs such a principle.

In the Singapore tests various types of cumulus cloud with vertical depths ranging from 1,500 to 41,000ft were detected, and the avoidance of responsive cloud was found to be extremely simple. Gaps in the cloud which were not apparent to the naked eye were prominently displayed on the cathode-ray tube. Avoiding action was always made directionally rather than by changing altitude. It was found that the safest way of avoiding turbulence was to skirt by at least half a mile all cloud areas giving radar responses. A number of instrument let-downs were also made with the search radar, and it was found that height could be reduced to 100ft over the edges of the alighting area with sufficient accuracy to effect a landing.

AIRLINE DOCUMENTATION

IMPLEMENTATION of Annex 9 to the Convention of International Civil Aviation, which deals with *Facilitation of International Air Transport*, is due on March 1st. M.C.A. Information circular No. 14/50 draws the attention of operators to the revised documentation which will then be required. The new forms include a general declaration (outward/inward) and passenger manifest and cargo manifest: among those which have now become obsolete are the former passenger and baggage list, aircraft declaration of health, the air navigation report, and the general declaration of cargo. Stores lists and notices of intended departure are still required, although the

CIVIL AVIATION NEWS . . .

latter type of document will have a more restricted use than in the past. The standards have to be implemented by all the 55 contracting states, unless they notify I.C.A.O. that differences will exist after March 1st between any of their practices and those established by the standards.

DC-3 WEIGHTS

IN the light of comments received from Contracting States, I.C.A.O. has reconsidered a resolution, adopted last March, on the limitation of DC-3 operating weights. It was previously decided that the country whose territory is entered or flown over always has the option to require maximum all-up weight to be limited to 26,200 lb (11,885 kg).

The amended resolution now stipulates that this limit shall be imposed only when carrying passengers; a limit of up to 26,900 lb (12,200 kg) may be imposed when no passengers are carried. The I.C.A.O. statement says that the Council appreciates that at certain airports or under certain conditions it may be unsafe to operate the DC-3 (or its variants) at the weights mentioned, and that the application of performance requirements relating aircraft weight to airport or other operating conditions might sometimes have the effect of restricting the weight to a figure lower than 26,200 lb.

AMERICAN RECOVERY

THE so-called "air coach" services and the increased carriage of freight are said to be the chief factors in the much improved financial position of the U.S. airline industry during 1949. A review of activities says that most regular airlines experienced the best year in their history. With very few exceptions, deficits were wiped out and companies operated at a substantial profit, to which the initiation of "coach" services materially contributed. Private flying, however, showed a considerable decline, although there are still 93,000 private aircraft registered in the United States.

BREVITIES

THE Guild of Air Pilots and Air Navigators is to hold its annual general meeting at Londonderry House on Thursday, April 13th, commencing at 6 p.m.

* * *

The B.E.A. mobile exhibition which toured Britain last year is now in Denmark. After a two week's stay in Copenhagen it will make a 4,000 mile tour of Germany, Austria, Italy, Switzerland, France and Belgium.

* * *

T.W.A. has applied to the C.A.B. for permission to use Constellations on its "coach" services. Conversion for such duties would enable a Constellation to carry up to 70 passengers. American Airlines recently obtained permission to use DC-6s for the same purpose.

* * *

To speed up South American services, B.O.A.C. will replace Yorks by Argonauts on the Buenos Aires route this month. The change will reduce flying time by 18 hours, and seat capacity per aircraft will be doubled. The new service starts on February 28th.

* * *

The number of passengers carried by Aer Lingus in January amounted to 10,558, a 54 per cent increase over the figures for the same month in 1948. More than half this number travelled on the London run, but on all routes substantial increases were seen. The amount of freight and mail carried was three times greater than in January last year, totalling 235,000 kg.

* * *

Air cargo accounted for 33,000,000 ton-miles of American Airlines' traffic last year. The company's revenue from this source totalled some $6,180,000 (approximately £2,200,000). Passenger-mileage in the same period amounted to 1,569,460,673, with a load factor of 64.6 per cent as compared with 60.4 per cent the previous year. The number of passengers carried reached the high figure of 3,250,000.

* * *

The French Minister of Public Works and Transport recently stated in the National Assembly that the capital investment programme for 1950 provides for the purchase of 6 Constellations, 10 DC-4s and 12 Breguet 761s for Air France.

* * *

The first two Cheetah-powered prototypes of the Spanish C.A.S.A. 201 Alcotan feederliner are at present carrying out their flight-test programme. A third prototype, to be fitted with Spanish-built Elizalde Sirio S-VIIA, is now under construction.

* * *

Statistics compiled by T.C.A. show that more than 650,000 passengers were carried by the Canadian company during 1949. This represents an increase of 23 per cent on last year's figure. Unduplicated route mileage now totals about 16,000, and services last year represented more than 100 flights daily.

* * *

Five men and one woman have been chosen to take part in I.C.A.O.'s third trainee programme. The course will be of five months duration and on its completion the trainees will return to their home countries to assist in maintaining closer liaison with I.C.A.O.

* * *

On January 24th, the twin-engined S.O.30 Bretagne made a proving flight from Orly to Rome; it carried 35 passengers and crew and completed the journey in 3 hr 25 min, an average of 199.4 m.p.h. This version was powered by Pratt and Whitney R-2800-B43, but improved performance is expected on the production models, which are to be fitted with the more powerful R-2800-CA18 series by the same manufacturer.

* * *

American Overseas Airlines announce the introduction of modified DC-4s, capable of carrying 64 passengers each, on the Frankfurt-Berlin service. The modifications reduce the unladen weight of the DC-4 from 46,823 lb to 44,953 lb, and the seating capacity is the largest offered by any aircraft on scheduled operations in Europe. It is intended to meet the increasing demands for air travel inside Germany; 20 round-trips weekly will be flown.

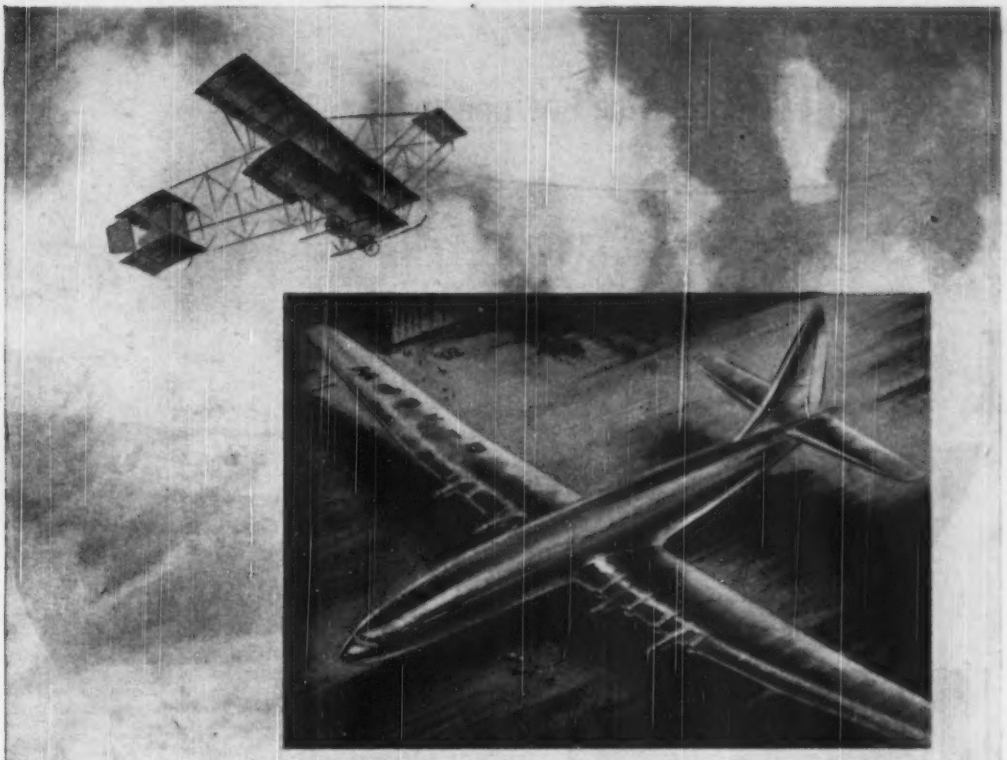
* * *

The new offices of Airprop, Ltd., at Terminal House, Grosvenor Gardens, London, S.W.1—an excellent position facing the Grosvenor Hotel at Victoria Station—were opened with an informal cocktail party on February 3rd. The company deals with airline and steamship passenger bookings, and there is also an air freight and shipping division. G/C. W. A. Rollason is the chairman.

* * *

By an agreement concluded with the Barbados Government, International Aeradio, Ltd., will operate and maintain airport facilities at Seawell Airport, Barbados. I.A.L. was earlier represented in this area by the appointment of an air-traffic controller at Atkinson Field, near Georgetown, on behalf of the British Guiana Government. International Aeradio, Ltd., also report that Mr. W. B. Britter, until recently on their staff at Asmara, has been seconded as radio adviser to the Jordan Government and will be concerned principally with the

CIVIL AND MILITARY: Sir Miles Thomas, on his "Comet-trail-blazing" tour to the Antipodes, is greeted at Tengah Airport, Singapore, by Gen. Sir John Harding, G.O.C. FARELF (Far Eastern Land Forces). B.O.A.C. is co-operating with the fighting Services in operations against the terrorists in Malaya.



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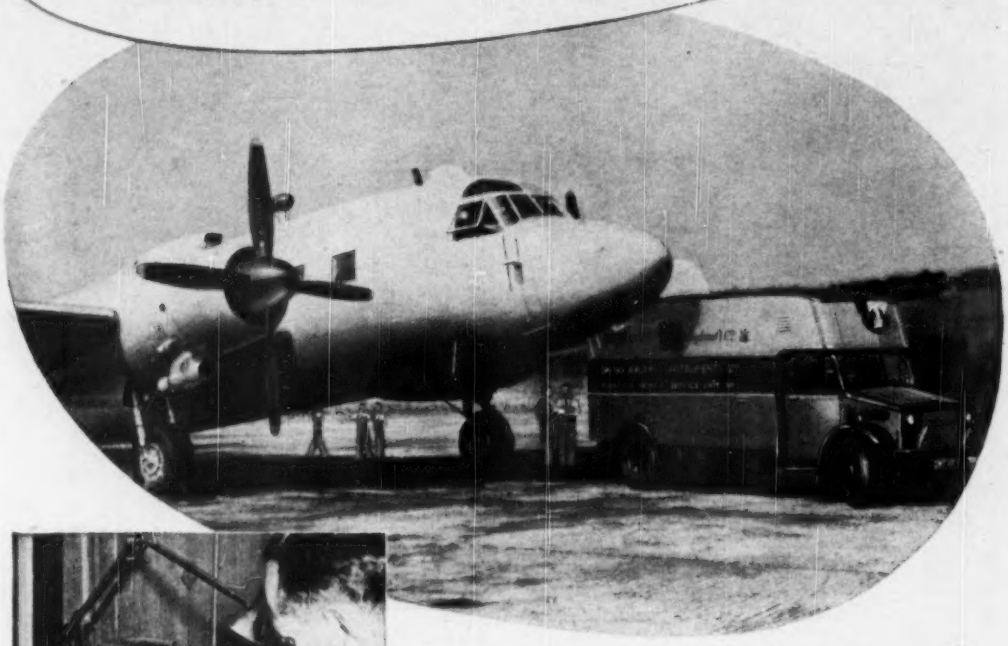
D9

SMITHS Service Engineers



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Smiths Service Engineers have been serving the aircraft industry for 15 years. Their job is to aid maintenance crews and aircraft inspectors during the installation and servicing of Smiths equipment. Their advice and assistance facilitate the carrying out of correct installation procedure after modification action. This team of experienced technicians, with its fully equipped mobile workshop and service vans, can visit the aircraft operator at the aerodrome whenever its services are needed. The continuous liaison service thus maintained between instrument manufacturer and aircraft operator ensures that every technical problem is studied and ironed out, and that nothing interferes with the maximum efficiency and serviceability of Smiths products.

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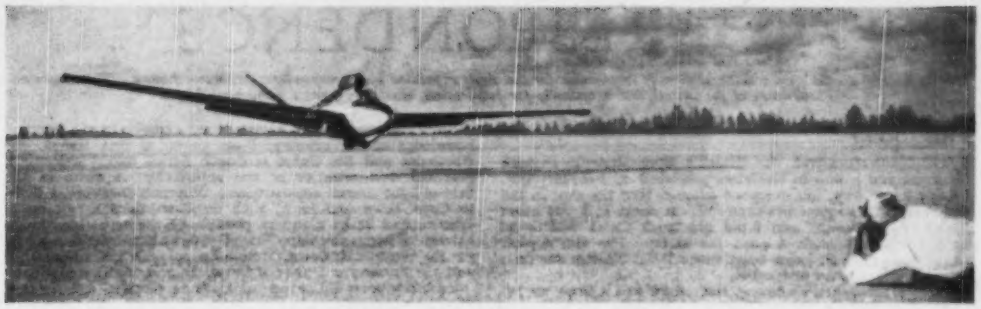

FOUGA IN FLORIDA: The French Fouga Cyclone glider—assisted by the 220 lb-thrust Pimené turbojet (type-tests of which were described in *Flight* of January 12th)—gives photographers the opportunity of a very low shot during a recent demonstration at the All-America Air Manœuvres at Miami. It was flown by the famous French aerobatic pilots Doret and Nicole.

CIVIL AVIATION NEWS . . .

modernization of facilities at Amman airport; and that International Aeradio (Pakistan), Ltd., have been appointed telecommunication agents for the Burmah Oil Co. (Pakistan Concessions), Ltd.

* * *

Air France announces that the 15- and 30-day excursion fares which for some months have been in operation on the London-Paris route are now extended to Birmingham, Manchester, Glasgow and Belfast. The Birmingham-Paris round-trip fare will now be £15 10s as compared with £18 previously. Whereas excursion passengers on the London service must travel during off-peak periods, provincial passengers may use any service.

* * *

In the recently published eighth Annex to the Convention on International Civil Aviation, I.C.A.O. has detailed the standards and recommended practices for airworthiness of aircraft. Transport category "A" is the only airworthiness category at present established, but others (for aircraft and for heavier-than-air machines other than power aircraft) will be added later. It is emphasized that contracting states are not at present under an obligation to issue certificates of airworthiness in category "A" (intended primarily for international air services) as the use of such aircraft is not mandatory for any type of operation.

* * *

Traffic at Kingsford-Smith Airport, Mascot, Australia, has reached such density that aircraft not equipped with radio are now diverted to Bankstown. The movement-rate often reaches 250 a day. At a cost of £25 million, Mascot Airport is being developed into a major international terminal. To overcome drainage problems the level of the ground will have to be raised approximately 9 ft., necessitating the provision of 800 million cubic yards of filling material.

* * *

The Handley Page Marathon I, G-ALUB, which left England last month on a demonstration tour, reached New Zealand on February 2nd; the 13,500-mile flight was made according to schedule and the aircraft is said to have functioned satisfactorily throughout. The Marathon has been handed over to the New Zealand National Airways Corporation for a period of testing over the airline routes, during which it is being flown by the Corporation's own pilots.

R.Ae.C. AVIATORS' CERTIFICATES

IN publishing the previous list of R.Ae.C. certificates (*Flight*, January 12th), covering those issued between 21.9.49 and 18.11.49, we remarked that, in spite of the current difficulties of the clubs and schools, there was still a steady flow of proficient pupils averaging about 30 a month. The latest list, given below, shows that this rate is being well maintained.

No.	Name	Club or School	Date
26,241	Robert Hugh Chapman	Qualified Service pilot	18.11.49
26,242	David Geoffrey van der Byl	Qualified Service pilot	21.11.49
26,243	Derek Paice	No. 7 F.T.S.	21.11.49
26,244	Kenneth Vyvyan Estcot Gilbert	R.A.F. College, Cranwell	21.11.49
26,245	Merle Day	Redhill Flying Club	22.11.49
26,246	Paul Stephenson	Southend Flying School	24.11.49
26,247	William Edward Thomas	Qualified Service pilot	28.11.49
26,248	Roy Tarbatt	No. 7 F.T.S. Cottesmore	28.11.49
26,249	Robert Exelby	Blackpool Aero Club	29.11.49
26,250	Tony Charles Armstrong	Southend Flying Club	1.12.49
26,251	Patrick Seassau	London Aeroplane Club	2.12.49
26,252	Ian Gordon-Johnson	R.A.F. College, Cranwell	5.12.49
26,253	Charles Henry Simpson	Plymouth & District F.C.	5.12.49
26,254	Cecily Elizabeth Roe	East Sussex Flying Club	5.12.49
26,255	Charles William Lambton	West London Aero Club	6.12.49
26,256	Peter Stewart Nielsen	Wirral Aero Club	8.12.49
26,257	Ronald Desmond Grasser	Wirral Aero Club	8.12.49
26,258	Gordon Edward Hughes	Qualified Service pilot	9.12.49
26,259	Alfred William Bedford	Qualified Service pilot	9.12.49
26,260	Laurence Stanley Johnson	Qualified Service pilot	9.12.49
26,261	Eric Henry James Thornton	Qualified Service pilot	9.12.49
26,262	Vithalbhai Ashabhai Patel	Air Service Training, Ltd.	9.12.49
26,263	Maung Mying Swe	Air Service Training, Ltd.	9.12.49
26,264	John Alan Fryer	R.A.F. College, Cranwell	12.12.49
26,265	Alfred Joseph Westaway	Qualified Service pilot	12.12.49
26,266	George Alfred Patrick	Southend Municipal School	12.12.49
26,267	John Munro Storie	Qualified Service pilot	12.12.49
26,268	James Thomson	No. 11 R.F.S.	12.12.49
26,269	Thomas Burke	Qualified Service pilot	12.12.49
26,270	Eric Stewart Alexander	Qualified Service pilot	12.12.49
26,271	Roy Victor Staley	R.A.F. College, Cranwell	12.12.49
26,272	Michael Charles Cameron De Courcy	Denham Aero Club	13.12.49
26,273	David Charles Walker	R.A.F. College, Cranwell	15.12.49
26,274	Frank Boyd Harvey	Qualified Service pilot	15.12.49
26,275	Frederick Leslie Clark	Darlington & District	15.12.49
26,276	Vincent McCann	Tees Side Flying Club	15.12.49
26,277	Madhav Ramchandra Naru	Air Service Training	15.12.49
26,278	Ronald Vivian Ecclestone	Qualified Service pilot	15.12.49
26,279	Laurence James Thomas O'Sullivan	R.A.F. College, Cranwell	16.12.49
26,280	Donald John MacDougall	Qualified Service pilot	16.12.49
26,281	Michael Gill	R.A.F. College, Cranwell	16.12.49
26,282	Edward Ralph Campbell	Qualified Service pilot	16.12.49
26,283	James Cary Elwes	West London Aero Club	20.12.49
26,284	Peter George Crawshay-Williams	Qualified Service pilot	20.12.49
26,285	Charles Eustace Albert Hall	Hampshire Aero Club	22.12.49
26,286	Anthony John Stone	Hampshire Aero Club	22.12.49
26,287	George Francis Hodder	Portsmouth Aero Club	22.12.49
26,288	Frederick William Mosey	United Services Flying Club	22.12.49
26,289	Peter Jones	Qualified Service pilot	23.12.49
26,290	Hashem Said Hashem	Air Service Training, Ltd.	28.12.49
26,291	George Robert Wiltshire	Air Service Training, Ltd.	28.12.49
26,292	Leonard Reginald Snook	Portsmouth Aero Club	28.12.49
26,293	Roy Starmer	No. 24 R.F.S.	28.12.49
26,294	Leonard A. Williamson	No. 24 R.F.S.	28.12.49
26,295	Ronald Albert John White	No. 24 R.F.S.	28.12.49
26,296	William Dennis Seabrook	No. 24 R.F.S.	28.12.49
26,297	Nicholas Graham Watson	Edinburgh University Air Sqdn.	30.12.49
26,298	Eric George Pearce	Qualified Service pilot	30.12.49
26,299	Christopher Watson	Herts & Essex Aero Club	2.1.50
26,300	Denis Oliver	Qualified Service pilot	3.1.50
26,301	Frances Marion Tyler	Notts Flying Club	5.1.50
26,302	Rita Margaret Powell	Notts Flying Club	5.1.50
26,303	Peter John Croft Phillips	R.A.F. College, Cranwell	9.1.50
26,304	Barbara Agnes Wheeler	R.A.E., Farnborough	10.1.50
26,305	Stanley Henry Rowland Grantham	Qualified Service pilot	11.1.50
26,306	Patrick Valentine Harrison	Qualified Service pilot	11.1.50
26,307	John James Graham	Qualified Service pilot	16.1.50
26,308	Thomas William Bell	Newcastle Aero Club	18.1.50
26,309	Anthony Maurice Canning	Qualified Service pilot	19.1.50
26,310	Maynard Maxwell Dalston	Qualified Service pilot	19.1.50
26,311	Basil Peter Mark Bayliss	R.A.F. College, Cranwell	23.1.50
26,312	Robert Edward Gamble	R.A.F. College, Cranwell	23.1.50

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Film Strip

YOUR correspondent, L. (Hawk's Eye) McArdle is both right and wrong in the letter published on February 9th. I don't know why, but everyone assumes that the shot in the *Wonder Jet* film represents Cranwell. It doesn t; I was never stationed at Cranwell and I did not teach Cadet Whittle to fly (whoever did made a good job of it). The film depicts an episode at C.F.S. (*circa* 1929) where P/O. Whittle was on a course and I was an instructor.

There are two anachronisms, but minor and I hope forgivable. The "blind take-off" was, as stated, later than in the scene of the "shot"; and I was not a two-striper as shown in the film. The trouble was, I have only one tunic and, if I had destriped myself, the marks would still have shown, owing to considerable fading of the cloth; I didn't want to look as if I had been stripped! W. E. P. JOHNSON.

London, W.1.

"Single-Seat Solos"

YOUR correspondent, Mr. Lewis G. Cooper (February 9th) repeats a very reasonable suggestion that was frequently made during pre-war years until the arrival of the Civil Air Guard scheme.

He (and all others interested in the matter of inexpensive flying) will find that the Ultra Light Aircraft Association is catering for those of restricted means, and that special arrangements are available to every enthusiast to make flying on ultra-light aircraft possible. Though the Chilton aircraft is not yet available, other suitable single-seater types can be had immediately at favourable hire-purchase conditions.

All particulars in respect to costs and conditions can be had from the Hon. Secretary, Ultra Light Aircraft Association, Royal Aero Club Aviation Centre, 19, Park Lane, London.

London, W.1. A. R. WEYL, A.F.R.Ae.S., U.L.A.A. Executive Committee.

A Travelling Farnborough?

IT has been suggested that British light-aircraft constructors should make a combined assault upon the overseas markets by means of local demonstration, publicity and forceful salesmanship. Certain manufacturers have been sending their own aircraft on lone tours overseas, but would not greater benefit accrue to the industry as a whole if a joint tour were arranged which would include fifteen to twenty aircraft truly representative of our light aircraft industry? In addition to the aircraft in the flight for demonstration and sale, there could be two or three larger aircraft carrying a cargo of accessories, equipment and other items for static display.

From correspondence I have received and also from a personal knowledge of the country, I am confident that Kenya, the Rhodesias and the Union of South Africa would welcome a practical demonstration of the superiority we claim in the field of light-aircraft construction. Why not, therefore, a flight to Cape Town and back, with demonstrations at all major centres, and at as many as possible of the secondary towns between Kisumu and Cape Town? The outward flight could go *via* the West Coast down through Leopoldville and Livingstone and the homeward flight *via* Cairo, Tripoli, Malta and Rome.

Such a tour would occupy about three months, and the cost per aircraft would be in the region of £1,500, as follows:

	£
Pilot's salary at £100 per month	300
Engineer's salary at £50 per month ..	150
Petrol for, say, 20,000 miles. Say 7 gallons per 100 miles at 2s per gallon	140
Oil—say 0.75 gallons per 100 miles at 5s per gallon	40
Accommodation and meal allowances, 30s per man per day	270
Landing fees, allow	100
Extras, allow	500
Total	£1,500

The prestige and publicity value of such a tour would be considerable, quite apart from the resulting business, and the cost is not prohibitive when the long-term view is taken.

There is not the slightest doubt that we have the aircraft, we have the men to fly them and we have the existing ground links with the countries overseas in the B.O.A.C. routes.

One feels that such a tour is a practical possibility, which, properly organized, would do an immeasurable amount of good.

Croydon, Surrey. SERVICE ENGINEER.

[While our correspondent's suggestion is enterprising, his costing is optimistic; several obvious items are disregarded. —ED.]

No Bomb

IN publishing the photograph (*Flight*, February 9th) of the Royal Air Force College, Cranwell, "as it looked in the days before it suffered damage from a German bomb," you presumably refer to the damaged roof on the left of the tower. If this is so, may I point out that the damage was actually caused by a Whitley crashing into it, and by the fire which followed? I was serving at the College at the time as Senior Engineer Officer. S. W. ROWLAND, S/L.

Horsham, Sussex.

[We thank this correspondent and others for pointing out the error.—ED.]

AUXILIARY A.F. FOR MALAYA

MALAYA Federal Council last week approved the establishment of an auxiliary air force. Some of the necessary aircraft and equipment are to be obtained from the Royal Air Force, which will also detach officers and men for the new organization, whose establishment has been under consideration since last April. It will be open to all races and will assist the R.A.F. in the defence of the whole Malayan Federation and Singapore.

GLASGOW UNIVERSITY SQUADRON DINES

THAT the Royal Air Force looked to graduates in engineering and science to provide the backbone of its technical staff was emphasized by A. Cdre. A. R. Wardle, C.B.E., A.F.C., in a speech at the first annual dinner and guest night of Glasgow University Air Squadron, held recently in the University Union. A. Cdre. Wardle has recently taken over command of No. 66 (Scottish Reserve) Group from A. Cdre. E. S. Burns, C.B.E.

The Senior R.A.F. Officer Scotland, A.V.-M. D. V. Carnegie, C.B., C.B.E., A.F.C., A.O.C. No. 18 Group, was also a guest, and presented replicas of the Weir Trophy to the winners during the past three years. The Weir Trophy was presented to the Squadron in 1947 by Viscount Lord Weir of Eastwood, P.C., G.C.B., a well-known Scottish industrialist, to be awarded to the best all-round member for each year.

Professor J. D. Mackie, C.B.E., M.C., M.A., of the Chair of Scottish History and Literature, and Deputy Principal of the University, proposed the toast of "The Squadron," and S/L. C. K. Bonner, the C.O., proposed "The Guests."

FORTHCOMING EVENTS

Feb.	17.	Institute of Navigation: "Air Traffic Control," a symposium of papers.
Feb.	21.	R.Ae.S. (Belfast): "Strength-testing of Aircraft," by Dr. P. B. Walker, M.A., Ph.D., F.R.Ae.S.
Feb.	21.	R.Ae.S. Section Lecture: "Air-intake Design for High-speed Aircraft," by Dr. J. Seddon, B.Sc.
Feb.	21.	R.Ae.C.: Film Show, Londonderry House.
Feb.	22.	R.Ae.S. (Preston): "Radar and the Aircraft which Use It," by B. W. Hodlin, B.Sc.
Feb.	22.	R.Ae.S. (Reading): "Propeller Turbines," by A. C. Clinton, F.R.Ae.S.
Feb.	23.	R.Ae.S. Graduates: "Problems of Heat Transfer," by W. R. Shapey, B.Sc., Grad. R.Ae.S., and J. Rivers, Grad. R.Ae.S.
Feb.	25.	Helicopter Association: "French Helicopter Development," by Col. R. M. Garry.
March	1.	R.Ae.S. (Weybridge): "Do Scientists Know Anything?" by C. G. Grey, F.M.R.Ae.S.
March	1.	R.Ae.S. Graduates: "Engineering Problems of Aircraft Design." (Joint meeting with I.E.E. and I.M.E. graduates.)
March	2.	R.Ae.S.: "Design for Maintenance," by R. G. Bishop, F.R.Ae.S.

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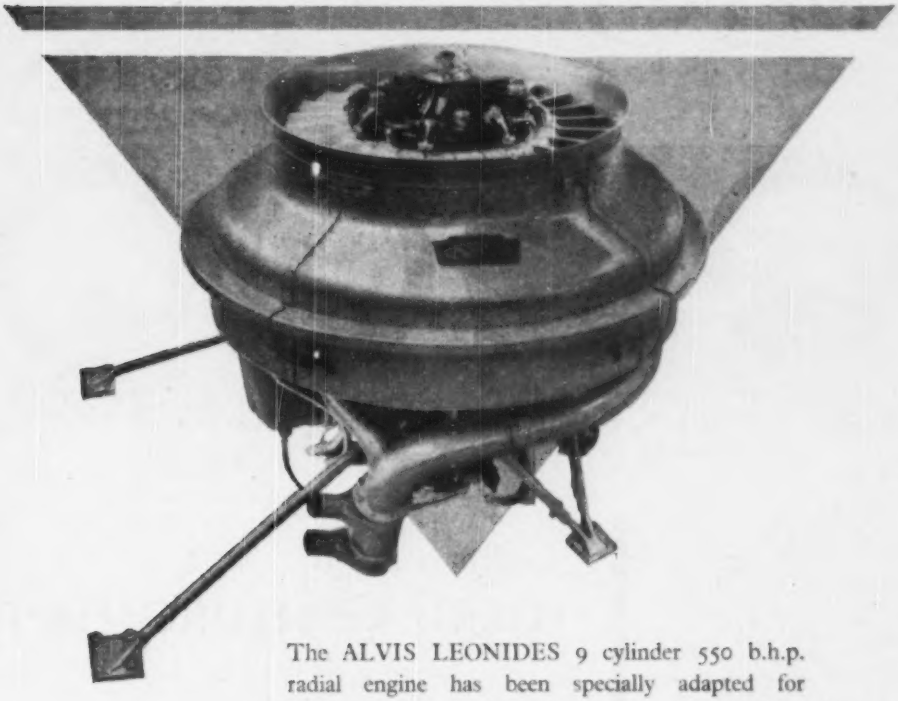

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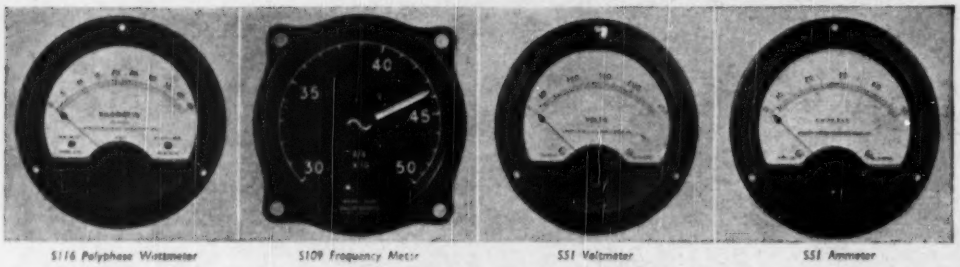

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WET WELCOME : Returning to H.M.S. *Implacable* from a Spring Cruise sortie, Sea Hornets of No. 801 Squadron found the flight-deck awash, the carrier having encountered a gale during their absence. No Sea Hornet has been damaged during the first thousand deck landings made by the type—a tribute to its handling characteristics as well as to the skill of Naval pilots.

Air Staff Reorganization

IMPORTANT changes in the constitution and organization of the Air Staff were announced by the Air Ministry last Thursday, February 9th. They involve appointments in two senior Air Staff posts and, concurrently, the leadership of three Commands.

In brief, Air Chief Marshal Sir Ralph Cochrane leaves Flying Training Command to take up the post of Vice-Chief of the Air Staff; the present V.C.A.S., Air Marshal Sir Arthur P. M. Sanders, becomes Deputy Chief of the Air Staff; and the present D.C.A.S., Air Marshal Sir Hugh Walmsley, fills the post of A.O.C.-in-C., Flying Training Command, vacated by Sir Ralph Cochrane.

Air Marshal Sir Aubrey Ellwood leaves Bomber Command for Transport Command, whose present C.-in-C., Air Marshal Sir Brian Baker, is retiring from the active list. Air Marshal Sir Hugh Lloyd takes over Bomber Command.

These changes, which have effect from March 1st, cancel certain of the appointments made last October, when it was announced that Sir Aubrey Ellwood would, "in February," become D.C.A.S.

The new Air Ministry announcement says that the changes, which arise from the increased work resulting from the North Atlantic and Brussels Treaties and a review of Air Ministry organization, involve division of the Air Staff, under the general direction of the new C.A.S., Air Chief Marshal Sir John Slessor, into two main groups under V.C.A.S. and D.C.A.S. The Vice-Chief will be mainly concerned with questions affecting the strength and fighting efficiency of the R.A.F., while the Deputy Chief will be chiefly occupied with inter-service policy and planning and with co-operation with the Commonwealth and allied air forces.

Careers of the new V.C.A.S. and D.C.A.S. are summarized below.

AIR CHIEF MARSHAL THE HON. SIR RALPH COCHRANE, K.C.B., K.B.E., A.F.C., who is 54 years of age, comes to his new appointment with the experience gained during

Sir Ralph Cochrane. Sir Arthur Sanders.

seven and a half years in continuous command of R.A.F. formations; for five years he has been a C.-in-C., first of Transport and latterly of Flying Training Command, and before that—during the latter half of the war—he commanded two Bomber Groups. From 1940 to 1941 he was Director of Flying Training, Air Ministry. He began his service in the R.N.A.S. during the first world war.

AIR MARSHAL SIR ARTHUR P. M. SANDERS, K.B.E., C.B., has been V.C.A.S. since November, 1948. Before that he had been A.O.C.-in-C., B.A.F.O., where he helped to lay the foundations of the Air Lift. During the war he was concerned, first, with R.A.F. ground defence (which led to the formation of the R.A.F. Regiment) and then with the planning of major operations as A.C.A.S. (Air) to Gen. Eisenhower; he was A.O.A. Bomber Command during the time of its peak effort against Germany, and in November, 1945, he was given the task of reorganizing the Staff College on a peace-time basis. Sir Arthur, who is now 51 years old, began his service in the R.F.C. in 1916; in 1917 he lost an arm in an air combat.

R.A.F. v. Army Boxing

ON Friday of last week a pre-war annual event, the Officers' Boxing Contest, R.A.F. v. Army, was revived at Oldham. An illustrated account of the match, in which the Army were victors by a narrow margin, will appear in these pages next week.

Armament at the Technical College

THIRD of the three divisions of the new R.A.F. Technical College to begin its courses is the armament division, recently formed at R.A.F. Station, Lindholme, where G/C. K. J. McKay has become station commander and assistant commandant of the college under the Commandant, A. Cdre. D. W. R. Ryley, C.B.E., whose headquarters are at R.A.F., Henlow. G/C. McKay was formerly on the directing staff of the R.A.F. Staff College.

The armament division has been formed from the technical element of what was formerly the Empire Air Armament School at Manby. In October, 1949, when the R.A.F. Technical College was formed, the technical element of the E.A.A.S. was taken over by the former, and became the Armament Division of

SERVICE AVIATION . . .

the College, a Signals Division being similarly formed from the old Empire Radio School at Debden, and an Engineering Division from the Engineering School at Henlow. The aircrew element of the old E.A.A.S. remained at Manby as the Weapons Branch of the new R.A.F. Flying College formed there about the same time. As before, only officers are now being trained at Lindholme. Airmen, armourers and armament technicians are trained at other establishments.

The Boyd Trophy

AWARDED annually for the finest feat of aviation of the year in the Royal Navy, the Boyd Trophy has been presented for 1949 to No. 1830 Squadron, R.N.V.R., for an outstanding performance in completing 205 deck landings during training in H.M.S. *Illustrious* last year. The squadron is commanded by Lt.-Cdr. (A) J. D. Murricane, D.S.C., R.N.V.R., and is based at Abbotsinch.

PROTOTYPE HATS: Air Chief Marshal Sir John Slessor, is seen above, with H.R.H. The Duchess of Gloucester and her committee, watching A/C.W. Bailey model one of the caps selected for the W.R.A.F., described on this page. Wearing the three selected caps (left) are A/C.W. Bailey of R.A.F. Wyton ; Sgt. Allsop of H.Q. Bomber Command ; and A/C.W. Wrigley of R.A.F. Station — Dishforth.

W.R.A.F. Appointments

THE following appointments have been made in the Women's Royal Air Force :—

Group Officer J. L. A. Conan Doyle, O.B.E., to be W.R.A.F. Staff Officer, Headquarters, Technical Training Command ;

Group Officer A. Stephens, M.B.E., to be Officer Commanding, W.R.A.F. Depot, Hawkinge;

Group Officer N. Dinnie, to be one of the Deputy Directors, W.R.A.F. ;

Group Officer N. M. Salmon, O.B.E., to be W.R.A.F. Staff Officer, British Air Forces of Occupation, Germany.

Hats for the W.R.A.F.

THREE peaked caps, from which a No. 1 head-dress for W.R.A.F. airwomen will finally be selected, have been chosen from thirty-two entries submitted by members of the Associated Designers of London by a committee presided over by H.R.H. The Duchess of Gloucester, Air Chief Commandant. Mr. Aage Thaarup, the well-known hat-designer, served on the committee, which included Air Chief Marshal Sir George Pirie ; Air Marshal Sir Hugh Saunders ; A. Cdre. C. E. Chilton ; Air Commandant Dame Felicity Hanbury ; and Group Officer N. M. Salmon.

The judging committee had a difficult task, for although the Director of the W.R.A.F. had laid down certain specifications the designs submitted varied considerably, and included a snappy little bowler, one or two models suggesting an "Afrika Korps" inspiration, an assymetrical peaked cap, and land-girl-style brimmed felts.

Three airwomen modelled the committee's selections. Two caps, designed by D. Carlton, Ltd., are very similar, having hard felt crowns, high at the front and fitting snugly at the back, and the W.R.A.F. badge mounted on a wide black braid. The third, by Dolores (Hats), Ltd., is a softer model with a dented front above the badge.

In making the final choice, durability of both shape and material under all weather conditions and regular hard wear has to be taken into consideration, and it has been arranged for the three types to be issued to W.R.A.F. personnel at various stations for "Service trials." The final selection will be sent to His Majesty the King for approval.

Gatow Gift

IN appreciation of the comradeship which existed between them during the Berlin air lift, the Army Forward Airfield Supply Organization at R.A.F. Station, Gatow, Berlin, has presented the R.A.F. Station with an oak shield bearing the badge of the Royal Army Service Corps.

Egyptian Air Force Trophy

AS a symbol of friendship, the Royal Air Force has presented a silver trophy to the Royal Egyptian Air Force, for award in connection with an inter-squadron air firing and bombing competition to be held by the R.E.A.F. The trophy—a fine example of British craftsmanship—is a sterling silver model of an eagle in flight, made to special order by the Goldsmiths and Silversmiths Co., Ltd., of Regent Street, London. It contains 60 ounces of silver, and is mounted on an ebonized wood plinth. On a silver plate, surmounted by the R.A.F. crest, is the inscription: "Inter-Squadron Air Firing and Bombing Trophy. Presented by Commander-in-Chief, M.E.A.F., Royal Air Force, with best wishes to the Royal Egyptian Air Force from the Royal Air Force."

The trophy was recently presented by the Commander-in-Chief, Middle East Air Force, Air Marshal Sir William Dickson, to the Director of the Royal Egyptian Air Force, A.V-M. Abdel Moneim Mikaati Bey, at an informal ceremony at the R.E.A.F. Headquarters, Heliopolis (Cairo).

Reunions

FIFTH annual reunion of No. 83 Group (R.A.F.) Officers' Association—at the Duke of York's Headquarters on March 31st. Tickets (5s 6d exclusive) from F. B. Berry, 11, Bush Hill Road, London, N.21.

* * *

First post-war dinner of the Royal Air Force Dinner Club.—March 24th, at the Connaught Rooms, Kingsway, London, W.C.2. Particulars from W/C. E. T. Rees, D.S.O., O.B.E., M.C., Room 234, Air Ministry, Kingsway, London, W.C.2.

* * *

No. 3 G.T.S. fourth reunion dinner.—The Goat and Compass Tavern, 321, Euston Road, London (Tottenham Court Road end) on Saturday, March 25th, at 7 p.m., for all ranks R.A.F. and W.A.A.F. Tickets (10s) from Joan Sherman, 121, Ashfield Road, Southgate, London, N.14. (Enterprise 3978.)

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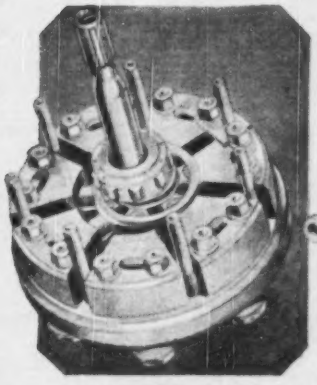
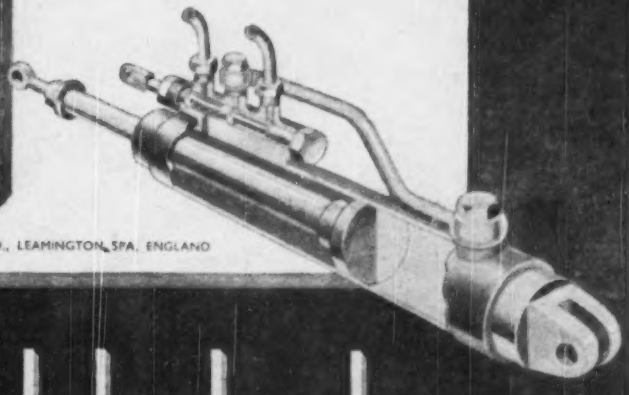
Among other valuable features, the "Servodyne" is simple, light, and 'self-lubricating' due to the hydraulic fluid; it is practically frictionless and thus does not hinder manual effort if the pressure is off. As the fluid in the system is 'pre-loaded', low-rate 'give' is avoided.



Below, at right, a diagrammatic "Servodyne" jack, showing the simple patented valve system.

At left, the Lockheed Mark VI pump, generally used with the "Servodyne".



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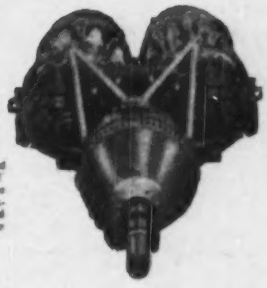

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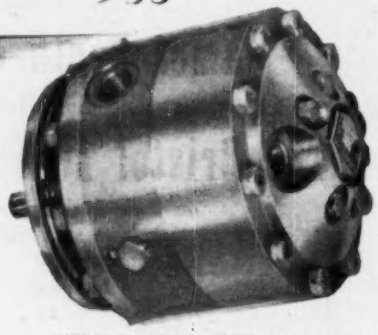

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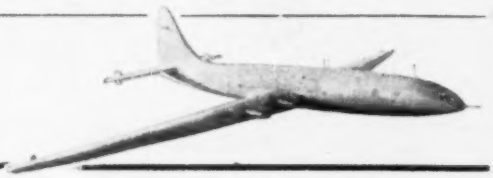

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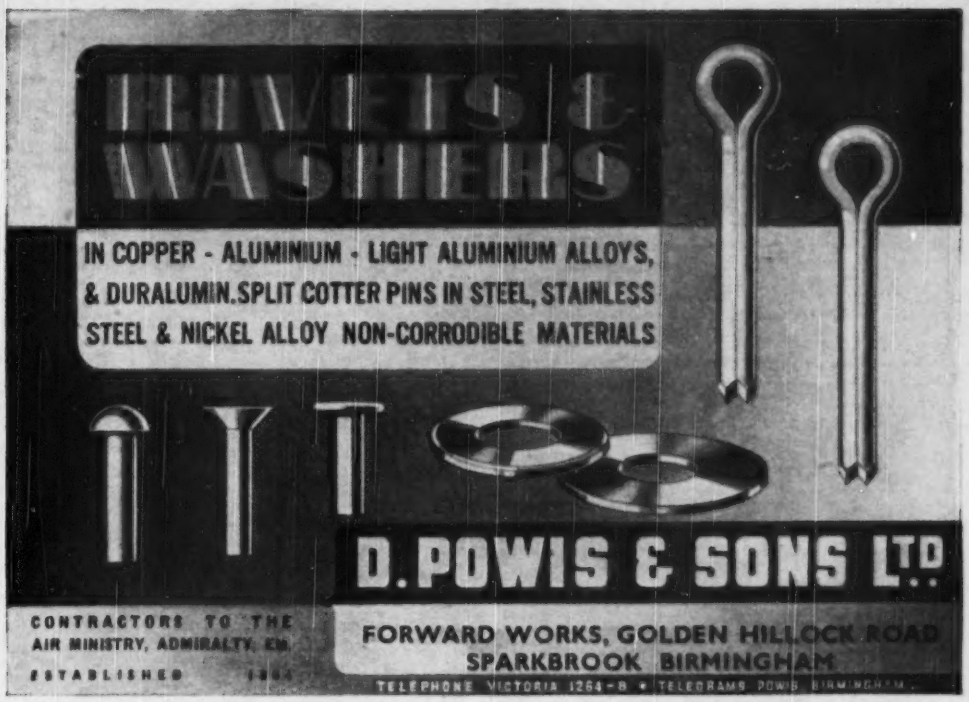
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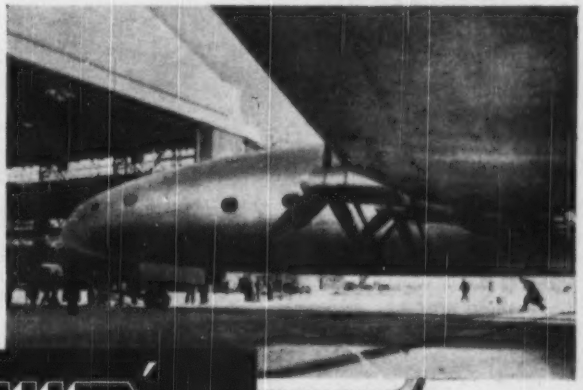

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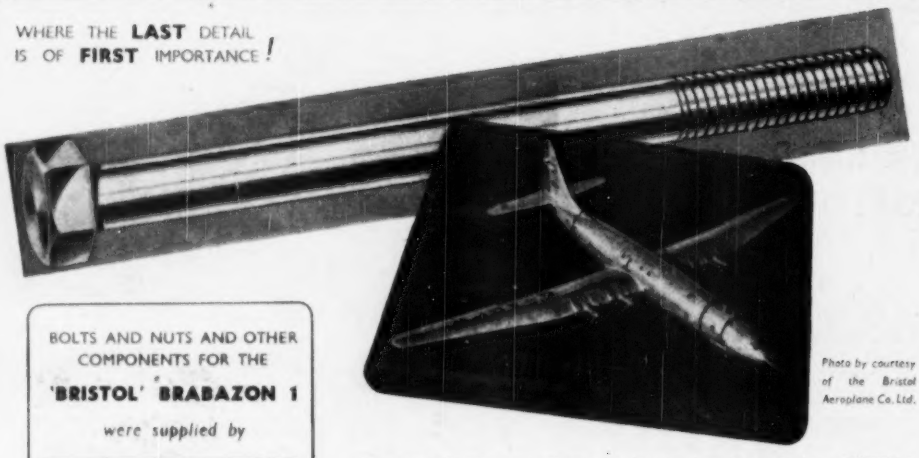

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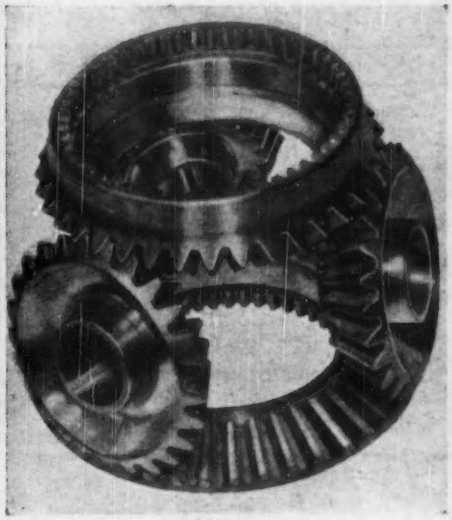

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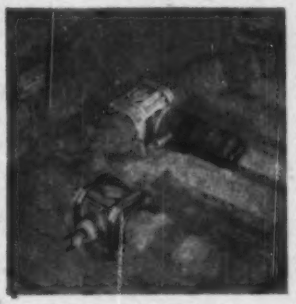

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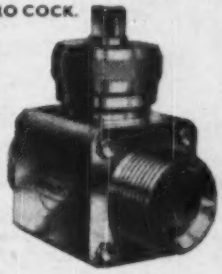

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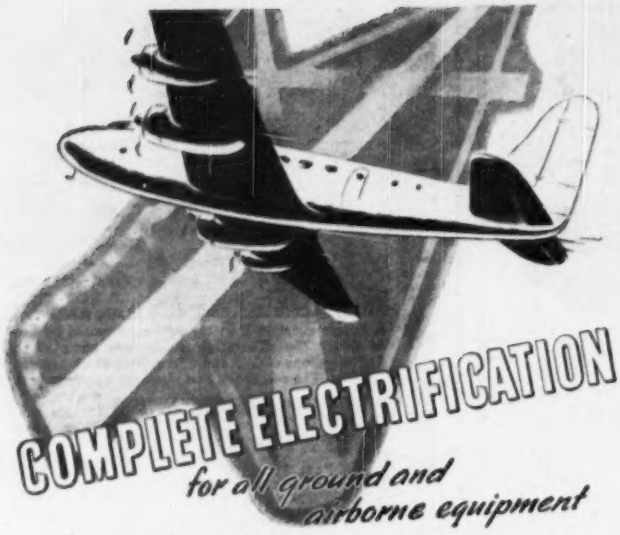

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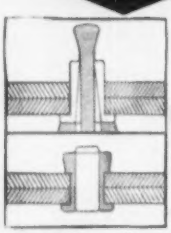

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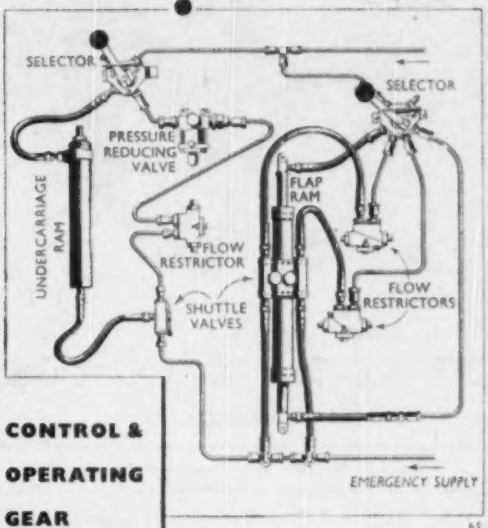

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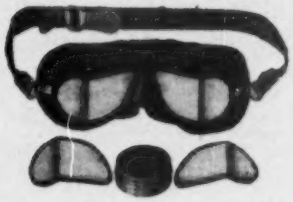

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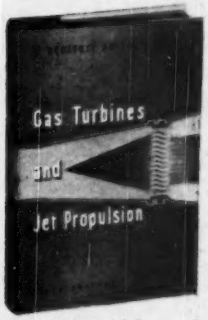

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Printed in Great Britain by The Cornwall Press Ltd., 1-6, Paris Garden, London, S.E.1, for Flight Publishing Company, Dorset House, Stamford Street, London, S.E.1. "Flight" can be obtained abroad from the following: Australia and New Zealand: Gordon & Gotch Ltd. India: A. H. Wheeler & Co. Canada: Imperial News Co., Gordon & Gotch Ltd. South African Central News Agency, Ltd. Wm. Dawson & Sons (S.A.), Ltd. United States: The International News Co. Entered as Second Class at the New York, U.S.A., Post Office.

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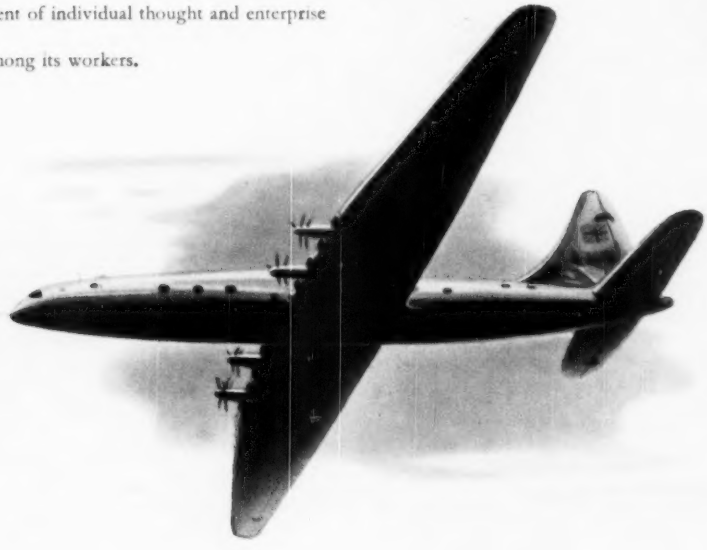

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